



Effigies Authoris

Arithmetick:

A

TREATISE

Defined for the Use and Benefit of
TRADES-MEN.

Wherein the
Nature and USE of FRACTIONS,
both *Vulgar* and *Decimal*, are
Taught by a New and Easie Me-
thod.

ALSO

The Mensuration of SOLIDS and
SUPERFICIES.

The Ninth Edition, Corrected and Amended.

By J. ATRES, at the *Hand* and
Pen in St. Paul's Church-yard.

London: Printed for Sam. Crouch, at the Cor-
ner of Pope's-Head-Alley next Cornhill: And
Tho. Norris at the Looking-Glass on London
Bridge. 1708.



To the Right Honourable
Sir *William Ashburst*, Kt.

LORD MAYOR

OF THE

City of LONDON.

This Manual of

Practical Arithmetick

IS

HUMBLY DEDICATED

AND PRESENTED

BY

Your Lordship's

Most obliged

Humble Servant,

7 NO 61

John Ayres.

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THE

THE PREFACE.

This Manual of Practical Arithmetick, adapted chiefly for the Benefit and Use of Tradesmen, is the Product of some vacant Hours. A Work for its Nature and End differing from any thing heretofore published that I know of: All the Rules being made plain and easie to the meanest Capacities, for whose sakes it is principally intended: which is the Reason so much of the Book is taken up in Explaining and Teaching the Ground-work, viz. Addition, Subtraction, Multiplication, and Division, which most Arithmetick Books are deficient in; a Defect in any of those Rules will render the Labours of such as learn Arithmetick by Books very difficult and hard. To help which I have first of all laid down the plainest way of Division for a Learner that wants the help of Master, and afterwards have given the shortest Italian way of Division: I have also omitted several Rules that are not of Use in Trade, such as Alligation barter, Loss and Gain, Company with Time, &c. And have supplied those Omissions with what is more Useful and Practical, viz. Great Enlargements, and Variety of the Golden Rule of Three, The Rule of Three Inverse, Double Rule of Three, and the Use of the Compound Rule of Five Numbers in working Interest, and the Nature of Exchange, Rules of Practice with great Variety, and short ways to cast up Merchandize. The Order of Deducting Tare and Tre, with other Rules useful in Trade. Lastly, I have made Fractions very easie and familiar (though differing from any former Method) having mixed both Vulgar and Decimal Fractions together under the same Head, that the Ingenious may discover the Use as well as Excellency and Brevity of the Decimal beyond the Vulgar Fraction. And as my Paper would admit, have added some Variety of Measuring Superficies and Solids.

The Faults in the former Impression, care has been taken to correct in this Ninth Edition.

Arithmetick.

CHAP. I. Of NUMERATION.

I. **A**RITHMETICK is the Art of Numbering well, or of Accompting well by Numbers; For as Magnitude or Greatness is the Subject of Geometry, so is Multitude or Number the Subject of Arithmetick.

II. The whole Art of Arithmetick depends upon the true Knowledge of the Five following Rules, viz. *Numeration, Addition, Subtraction, Multiplication, and Division.* All the other Rules being compounded of these, we shall treat particular of them in their order.

III. *NUMERATION* Teacheth to express or write down the value of any Number whatsoever proposed.

IV. All Numbers are written with ten Characters called Figures, of which the last is called a Cypher, and of it self signifieth nothing, but serveth (according as it is placed) to increase or diminish the value of another Figure to which it is either annexed or prefixed.

V. The Ten Characters or Figures by which all Numbers are expressed, are thus written, viz. 1 one; 2, two; 3, three; 4, four; 5, five; 6, six; 7, seven; 8 eight; 9, nine; 0, Cypher; The Nine first of these are called significant Figures.

VI. All Numbers are either *Simple* or *Compound*

1. A Number is said to be *Simple*, when it consisteth but of one *Figure*, as 4, 9 and 6, &c. are simple or single Numbers.

2. A Number is said to be a *Compound* Number when it is composed of two, three, four, or more *Figures*; such as are 35, 356, and 7428, &c.

VII. Every *significant Figure* hath a double Value, viz. *Certain* or *Uncertain*.

1. The value of a *Figure* may be said to be *certain*, when it signifieth simply its own proper value, without the Addition of any other word for its explanation, and so 4 signifieth four, 8 signifieth eight, and 9 is nine, &c.

2. The value of a figure may be said to be *uncertain*, in respect of the place it may stand in, and so 4 may signify forty, or four hundred, or four thousand, &c. and 8 may signify eighty, or eight hundred, or eight thousand, &c.

VIII. When a Number is composed of divers *Figures* set together like the Letters in a word, that Number is said to consist of as many places as there are *Figures* used in the composing thereof. So the Number 4643 is said to consist of four places, because it is composed of four *Figures*; the like is to be understood of any other.

IX. The places in every *Compound* Number are to be considered both as to their order, and their value.

1. The Order of the places is from the right hand to the left, the first *Figure* or Cypher towards the right hand is said to possess the first place, and the next towards the left hand, is said to possess the second place, and the next to that the third place, &c.

Chap. I. Of Numeration.

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So if this Number were proposed, viz. 3734, here 4 is said to possess the first, 3 the second, 7 the third, and 3 the fourth place, &c.

2. The value of every Figure is discovered by the place that it stands in; viz. The first place is the place of *Unites*, or ones; and the Figure that standeth in that place signifieth its own proper or simple value. The second place is the place of *Tens*, and the figure that standeth there signifieth as many *Tens* as the Figure it self containeth *Unites*: As if it be 4, it signifieth four *tens*, or forty; if it be 7 it signifieth seven *tens*, -or seventy, &c. The third place is the place of *Hundreds*, and the Figure that standeth there, is as many *hundreds* as it containeth *Unites*: So 5 in the third place is five hundred, and 6 signifieth six hundred, &c. The fourth place is the place of *Thousands*, and the Figure that standeth therein signifieth as many *thousands* as it contains *Unites*; so 8 in the fourth place is eight thousand, and 4 is four thousand, &c. As,

Suppose this Number, viz. 4652, were given to have its value expressed; The figure 2 (in the first place) is two *unites*, or simply two; the figure 5 (in the second place) is five *tens* or fifty; so 52 is thus expressed, viz. fifty two: The figure 6 (in the third place) is six hundred, so 652 is thus expressed, viz. six hundred fifty two; the figure 4 (in the fourth place) is four thousand, so 4652 is thus to be read, viz. Four thousand six hundred fifty two.

In like manner if any figure hath a *Cypher*, or *Cyphers* annexed to it, it shall still retain the value of its place, as much as if a significant figure, or figures, were annexed to it in the room of the *Cypher* or *Cyphers*; so if the figure 6, there

be a Cypher, annexed thus (60) its value is *six tens* or *sixty*, because it standeth in the second place, or place of *Tens*. Likewise if it have two Cyphers annexed to it thus (600), its value is *six hundred*, because it possesseth the third place, or place of *Hundreds*. Also 6000 is *six thousand*, because 6 standeth in the fourth place, or place of *Thousands*.

And the value of any Figure increaseth in a Decuple proportion from the right hand to the left, every place being *ten times* the value of the former, as you may see in the following Table.

Numeration Table.

Hundreds of Millions	Tens of Millions	Millions	Hundreds of Thousands	Tens of Thousands	Thousands	Hundreds	Tens	Unites	
9	8	7	6	5	4	3	2	1	The Numbers in the Table are thus to be Read, viz.
									987 Mil. 634 Th. 321.
1	2	3	4	5	6	7	8	9	123 Mil. 456 Th. 789
	2	3	4	5	6	7	8	9	—23 Mil. 456 Th. 789
		3	4	5	6	7	8	9	—3 Mil. 456 Th. 789
			4	5	6	7	8	9	—456 Th. 789
				5	6	7	8	9	—56 Th. 789
					6	7	8	9	—6 Th. 789
						7	8	9	—789
							8	9	—89
								9	—9

Over

Over against every place of the Numbers in the foregoing Table is written (in words at length) the value thereof ; viz. *Unites, Tens, Hundreds, Thousands, &c.* which words being perfectly gotten by heart, and well understood, the Learner will be thereby enabled to express or write down the value of any Number proposed.

And on the right hand of the Table, over against every Number therein contained, you have direction how to read or express those Numbers : As 987654321 is thus to be read, viz. *Nine hundred eighty seven Millions, six hundred fifty four thousand three hundred twenty one.* And the like is to be understood of the rest.

Note, Although the foregoing Table be made to consist but of Nine places, yet it may be continued to more places at pleasure, even *ad infinitum*, observing that the value of every place is ten times as much as that which goeth before it ; so the tenth place is *Thousands of Millions*, the eleventh place is *Tens of Thousands of Millions*, the twelfth place is *Hundreds of Thousands of Millions*, and the thirteenth place is *Millions of Millions, &c.*

There is yet another Method used by some, that is very plain and useful in the expressing of great Numbers, or Numbers consisting of many places which is this, viz. make a point after every third Figure, beginning at the right hand, as in the following Example.

Let this Number be proposed consisting of fourteen places, viz. 84639042724536, and when every third figure is pointed it will be thus, viz. 84. 639. 042. 724. 536. every three figures being called a period, and are reckoned in order from the right hand towards the left viz. 536 is the first Period, 724 is the second Period,

Period, *or* the third, &c. the first Period (which is 536) consisteth of *Units, Tens, and Hundreds*, and is thus expressed, *viz.* *Five Hundred Thirty six*, and every other Period is to be read in every respect as if it stood in the place of the first Period, only in expressing the value of the second Period, you must add thereto the word *Thousand*; to the third Period you must add the word *Millions*; to the fourth Period the word *Thousands*; to the fifth Period *Millions of Millions*; and so the Number before proposed is to be read as followeth, *viz.*

Millions of Millions	Thousand	Millions	Thousands
84	639	042	724 536

Eighty four *Millions of Millions*, six hundred thirty nine *Thousand*, forty two *Millions*, seven hundred twenty four *Thousand*, five hundred thirty six.

C H A P. II.

Of ADDITION.

ADDITION Teacheth to add, or put together divers Numbers, and to bring them to one total Sum. As if seven and 9 were given to be added

added together their Sum will be 18; and the Sum of 5 and 4 is 9.

II. *Numbers* to be added together, each of them consist either of one Denomination, or of divers, as if it were required to add 16*l.* to 14*l.* here both the given numbers are of one Denomination, being Pounds only, without Shillings, Pence or Farthings: But if it were required to add 36*l.* 14*s.* 06*d.* to 18*l.* 12*s.* 06*d.* these consist of divers Denominations, viz. of Pounds Shillings and Pence.

III. When it is required to add together several Numbers of one Denomination, they must (in order to the work) be disposed of according to the following Rule, viz.

Place the given Numbers one under the other in such order, that Units may stand under Units, Tens under Tens, Hundreds under Hundreds, Thousands under Thousands, &c.

If you were to add 136 and 42 together, they must be placed one under the other as followeth, viz.

136
42

Or,

42
136

IV. Having placed the given Numbers as before is directed, then draw a straight line under them, and (beginning at the place of Units) add all the Figures together that stand over one another in that Rank; putting their Sum under the said straight Line; as in this Example, I say, 2 and 6 is 8, wherefore I put 8 under the Line, and in its proper place, viz. under 2 and 6 and proceed to the next Rank which is the place of Tens, saying, 4 and 3 is 7, whereof I put 7 in its

its proper place under the line; and proceed to the next and last rank, where I find only 1, wherefore I put one in its proper place under the line, and so the work is finished, and I find thereby that the Total Sum of 136 and 42 to be 178; See the Operation as followeth.

$$\begin{array}{r}
 136 \\
 42 \\
 \hline
 178
 \end{array}$$

V. If in adding together any of the Ranks (as is before directed) their Sum amounts to, or exceedeth 10, or any number of tens, then in such case you are either to set down a *Cypher* under the line in its proper place, or else the *excess* above the *ten* or *tens*; and for every *ten* carry an *unit* to be added to the next *Rank* of *Figures*. As if it amount to 30, then set down (0) a *Cypher*, and carry 3 (for the three *tens*) to be added to the next *Rank*, if it amount to 34, then set down 4 under the *Rank* that you added, and carry three to the next, &c. And when you have cast up the last *Rank* or *Series* towards the Left Hand, set down the Total that it amounteth to, as in the following Examples.

(1)	(2)	(3)	(4)
748	4758	1848	20864
364	6473	3472	78987
296	2894	1865	6217
242	1862	3479	4320
Sum 1650	15987	10464	110380

Chap. 2. Of Addition.

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In the first of these Examples I begin, saying, 2 and 6 is 8; and 4 is 12, and 8 makes 20, which is just two tens; wherefore I put down 0 under the line and carry two to the next Rank for the 2 Tens; and proceed, saying, 2 that I carry and 4 is 6, and 9 is 15, and 6 is 21, and 4 is 25, which is 5 above twenty, wherefore I put down 5 under the line, and carry 2 for the two tens to the next Rank, and then proceed, saying, 2 that I carry and 2 is 4, and 2 is 6, and 3 is 9, and 7 makes 16, wherefore (because it is the last rank) I put down 16 under the line, and so the work is finished, the total Sum of the Addition being 1650: The same is to be observed in the rest of the Examples,

VI. Addition of *divers Denominations* cannot be well performed, until you know the value of common Coins, Weights, and Measures, &c. As how many Pence make 1 Shilling, how many Shillings make 1 Pound, and how many Ounces make 1 Pound, how many Pound make a Quarter of a C. and how many Quarters make a C. weight.

In Addition of *English Money*, it is necessary first of all to understand the meaning and signification of the Characters superscribed over every Sum, as *li. s. d.*

Note, That *li* signifies, *Libra*. a Pound, not here in respect of common Weight, but *Money*, and for distinction is called a *Pound Sterling*. So *s.* stands for *Solidus* (a Coin of Brass) used by the *Romans*, but with us of *Silver*, and signifies a *Shilling*, twenty of these pieces make one *Pound Sterling*.

de. or *d.* stands for *Denarius*, a Penny, which contained ten Pieces of the *Romans* least Coin: It hath had a various Estimate in our *English Coins*. It now signifies a Penny, the 12 part of a Shilling, or 12 of which make a Shilling. For until
the

the Reign of Henry VI. a Penny was the 20th part of an Ounce of Silver, and in his Reign made the 30th. By Edw. IV. 40 Pence made an Ounce. By Henry VIII. there was allowed 45 d. to the Ounce. And by Q. Elizabeth an Ounce of Silver was divided into 60 parts, called Pence, as it is at this day.

ADDITION of MONEY.

Note, 4 Farthings is a Penny, 12 Pence a Shilling, and 20 Shillings a Pound Sterling, or English Money.

The following Tables ought to be learned by heart.

12 times		d.	s.	d.
1	12	20 is	1	8
2	24	30	2	6
3	36	40	3	4
4	48	50	4	2
5	60	60	5	0
6	72	70	5	10
7	84	80	6	8
8	96	90	7	6
9	108	100	8	4
10	120	110	9	2
11	132	120	10	0
12	144			

VII. When it is required to add together Numbers consisting of divers Denominations, you are to place the given Numbers in such order one under the other, that each Rank may consist of one and the same Denomination. That is to say, if it be in Money: Let Pounds be set under Pounds, Shillings under Shillings, Pence under Pence, and Farthings under Farthings. The like is to be understood of Weight, Measure, Time, &c.

Then

Then (having first drawn a Line under them) add them together, considering how many of each smaller Denomination make an Unit of the next that is superior to it, (always observing to begin at the least Denomination) and for every such Unite, carry 1 to the next superior Denomination, viz. If it be in Addition of Money, for every 4 in the Farthings you must carry 1 to the Pence (because 4 Farthings is a Penny); For every 12 in the Pence carry 1 to the Shillings (because 12 Pence is a Shilling); and for every 20 contained in the Shillings, carry 1 to the Pounds) because 20 Shillings is a Pound); And the odd Farthings, Pence and Shillings, set down in their proper Banks under the Line, as in the following Example.

Some do indeed make a place of *Farthings*, and set a *q.* over them for *quartillier*, which is not very proper, and seldom used by Men of Business; therefore when you would write down three Farthings, or a Half penny, or a Farthing, write it thus:

$\frac{3}{4}$ ——— Three Farthings.
 $\frac{1}{2}$ ——— A Half-penny.
 $\frac{1}{4}$ ——— A Farthing.

Let it be required to add together 134 l. 16 s. 08 d. $\frac{1}{4}$ and 286 l. 10 s. 4 d. $\frac{1}{2}$ and 498 l. 13 s. 06 d. $\frac{1}{4}$ and 794 l. 18 s. 09 d. $\frac{1}{2}$. Then in order to the work I set them down and draw a Line under them, as followeth.

l.	s.	d.	
134	: 16	: 08	$\frac{1}{4}$
286	: 10	: 04	$\frac{1}{2}$
498	: 13	: 06	$\frac{1}{4}$
794	: 18	: 09	$\frac{1}{2}$

First,

First, I begin with the least Denomination, which is that of Farthings, and add them together, saying, 4 and 5 is 9, and 1 is 6, and 1 is 7 Farthings, which is 1 Penny and 3 Farthings, wherefore I put 3 Farthings under the Line, and under the Denomination of Farthings, and carry 1 (for the Penny) to the next Denomination of Pence, saying, 1 that I carry and 9 is 10, and 6 is 16, and 4 is 20, and 8 is 28, now 28 Pence is 2 Shillings 4 Pence, wherefore I put 4 under the Line, and carry 2 Shillings to the Denomination of Shillings, saying, 2 that I carry and 18 is 20, and 13 is 33, and 10 is 43, and 16 is 59 Shillings, which is 2 Pounds 19 Shillings, whereof I put the 19 Shillings under the Line, and under the Denomination of Shillings, and carry 2 (for the 2 Pounds) to the Denomination of Pounds, and proceed, saying, 2 that I carry and 4 is 6, and 8 is 14, and 6 is 20, and 4 makes 24, wherefore I put down 4 under the Line, and carry 2 for the two tens to the next Rank, saying, 2 that I carry and 9 is 11, and 9 is 20, and 8 is 28, and 3 is 31, which is 1 above 30, wherefore I put 1 under the Line and carry 3 (for the three tens) to the next Rank, and proceed saying, 3 that I carry and 7 is 10 and 4 is 14, and 2 is 16, and 1 is 17, wherefore I put 17 under the Line, because it is the Sum of the last Rank, and so the whole work is finished, and I find the Sum of the given Numbers to be 1714*l.* 19*s.* 4*d.* 03*q.* as by the following work appeareth.

<i>l.</i>		<i>s.</i>		<i>d.</i>	
134	:	16	:	08	$\frac{1}{4}$
286	:	10	:	04	$\frac{3}{4}$
498	:	13	:	06	$\frac{1}{2}$
794	:	18	:	09	$\frac{1}{4}$

Sum 1714 : 19 : 04 $\frac{3}{4}$

To prove your Addition after you have added up your whole Sum, draw a Line with your Pen under the uppermost Number, or Sum, and then add together all the other Numbers, except the uppermost. And when you have so done, add the Amount, or Sum thereof to the uppermost Sum above the Line. And if that Sum be equal to the Sum first found, the Work is true, otherwise not.

Here, Note once for all, that whatsoever Sums you are to add together, whether of Money, Weight, Measure, Time, &c. That when you come to the greatest Denomination, as you cast up the several Ranks thereof, you are to carry the Tens of every preceding Rank to that which follows it, as is directed in the Fifth Section of this Chapter, and as the Ranks in the Denomination of Pounds in the last Example are cast up.

The Old common way of Addition of Money, is to make a *speck* or Tittle with your Pen at every 12 that is found in the Addition of your Pence, and so many specks as you find, carry so many Shillings to the place of Shillings, setting down what remains above 12 under the place of Pence. Then make a speck at every 20 you find in the Addition of your Shillings, and for so many specks carry so many Pounds to the place of Pounds, setting down the *overplus* under the place of Shillings, and then proceed to add up the Pounds.

Bue

But the best Method, which I would commend to your Practice is this :

First, Cast up your Pence, or make a small Comma at every 60d. which is 5s. (and it will be a great ease to the Memory where Sums are long) and by the foregoing Table you may readily know, how many Shillings and Pence your Pence amount to ; then set down your odd Pence under the place of Pence, and carry your Shillings to the Unit of Shillings, and add them up as in Addition of Numbers, by setting down the odd above the Tens, and carry the Tens to the Tens of Shillings, or Angels (because 10 s. is an Angel) then for every two in place of Angels carry so many Pounds to the place of Pounds. An Example or two will make it plain and easier.

Example I.

A Shop-keeper looking over his Shop-book, finds that A owes him 195 l. 11 s. 9d. $\frac{1}{2}$ B 57 l. 34 s. 10 d. $\frac{1}{4}$ C 450 l. 10 s. 2 d. D 27 l. 16 s. 11 d. $\frac{3}{4}$ E 44 l. 13 s. 9d. $\frac{1}{2}$ F 100 l. G 8 l. 14 s. 9 d. $\frac{1}{2}$ H 160 l. 10 s. 2 d. $\frac{1}{4}$ I 54 l. 11 s. 11 d. K 73 l. 9 s. 10 d. $\frac{3}{4}$.

In order to the work, place the Sums one under the other, as is before directed, thus.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
— A	195	: 18	: 9 $\frac{1}{2}$
— B	57	: 14	: 10 $\frac{1}{2}$
— C	450	: 10	: 2
— D	27	: 16	: 11 $\frac{1}{2}$
— E	44	: 13	: 9 $\frac{1}{2}$
— F	100	: 00	: 0
— G	8	: 14	: 9 $\frac{1}{2}$
— H	160	: 10	: 2 $\frac{1}{2}$
— I	54	: 11	: 11
— K	73	: 09	: 10 $\frac{1}{2}$
Sum	1173	: 14	: 4 $\frac{1}{2}$

Then begin with the least Denomination towards the right hand, which is Farthings, saying, 1 and 2 is 3, and 2 is 5, and 2 is 7, and 3 is 10, and 1 is 11, and 2 is 13 Farthings, which is 3 Pence $\frac{1}{2}$, wherefore put down $\frac{1}{2}$ under the Farthings, and carry 3 Pence to the place of Pence, and say, 3 and 10 is 13, and 11 is 24, and 2 is 26, and 9 is 35, and 9 is 44, and 11 is 55, and 2 is 57, and 10 is 67, and 9 is 76. Now by your Table 72 Pence is 6 s. therefore 76 is 6 s. 4 d. wherefore put down 4 d. under the place of Pence, and carry 6 s. to the place of Shillings, saying, 6 that you carry and 9 is 15, and 1 is 16, and 4 is 20, and 3 is 23, and 6 is 29, and 1 is 30, and 1 is 31, and 1 is 32, wherefore put down 4 under the place of Shillings, and carry three Tens to the place of Tens of Shillings, or Angels, and say, 3 that you carry and 1 is 4, and 1 is 5, and 1 is 6, and 1 is 7, and 1 is 8, and 1 is 9, and 1 is 10, and 1 is 11; now, 11 Angels, or 11 ten Shillings is 5 l. 10 s. or 5 l. 1 Angel,

get, therefore place 1 Angel under the Angels, and it makes the 4 to be 14 s. which place under the place of Shillings, and carry 1 Pound to the place of Pounds, and finish the Work as before directed; and the Total Sum found will appear to be 1173 l. 14 s. 4 d. $\frac{1}{4}$.

Example II.

A Banker on the Ballance of his Books, finds himself indebted to L. 30. 11. 10 s. 3 d. $\frac{1}{4}$ to M. 100 l. 10 s. 10 d. to N. 25 l. 7 s. 8 d. $\frac{1}{4}$ to O. 59 l. 17 s. to P. 307 l. 16 s. 10 d. $\frac{1}{4}$ to Q. 7 l. 14 s. 9 d. $\frac{1}{4}$ to R. 37 s. to S. 25 s. 11 d. $\frac{1}{4}$ to T. 415 l. 10 s. 9 d. to V. 76 l. 13 s. 9 d. $\frac{1}{4}$ to W. 100 l. to X. 15 s. 11 d. $\frac{1}{4}$ to Y. 17 l. 17 s. to Z. 10 l. 00 s. 4 d. $\frac{1}{4}$

L	30	11	10	3	$\frac{1}{4}$
M	100	10	10		
N	25	7	8	$\frac{1}{4}$	
O	59	17	0		
P	307	16	10	$\frac{1}{4}$	
Q	7	14	9	$\frac{1}{4}$	
R	37	17	0		
S	25	11	11	$\frac{1}{4}$	
T	415	10	9		
V	76	13	9	$\frac{1}{4}$	
W	100	00	0		
X	15	11	11	$\frac{1}{4}$	
Y	17	17	0		
Z	10	00	4	$\frac{1}{4}$	
Sum	1375	18	3	$\frac{1}{4}$	

First

First of all add up your Farthings, as before directed, and they make 15, which is 3d. $\frac{1}{2}$ place $\frac{1}{2}$ under the Farthings, and carry 3 Pence to the Pence, and say, 3 and 4 is 7, and 11 is 18, and 9 is 27, and 9 is 36 and 11 is 47, and 9 is 56, and 10 is 66, at which 10 make a Comma, because 66 d. is 9s 6d. then proceed and carry 6d. to the next Figure; which is 8, and say, 6 and 8 is 14, and 10 is 24, and 3 is 27. Now 27d. is 2s 3d. and the 5s before makes 7s 3d. wherefore set down the 3 Pence under the place of Pence, and carry 7 Shillings, to the place of Shillings, and proceed to finish your Sum as was taught you in the last precedent, and the Total Sum will appear to be 1375 l. 28 s. 3d. $\frac{1}{2}$

Addition of Averdupois Weight.

Note, That 16 Drains is an Ounce, 16 Ounces is a Pound, 28 Pound is a Quarter of an Hundred, 4 Quarters is an Hundred weight, consisting of 112 Pounds; and 20 Hundred is a Tun Averdupois weight.

The Marks or Characters by which this weight is known or expressed are these, viz. For Tuns (T) Hundreds (C) Quarters (Qr.) Pounds (lb.) Ounces (oz.) Drains (dr.) As in the following Examples.

Tun

<i>£</i>	<i>s</i>	<i>d</i>	<i>q</i>	<i>lb</i>	<i>£</i>	<i>s</i>	<i>d</i>	<i>q</i>	<i>lb</i>
25	14	2	1	24	154	1	19	1	10
37	16	3	1	15	275	3	19	1	11
42	10	1	1	17	476	2	10	1	07
96	14	2	1	27	39	8	14	1	08
54	17	2	1	18	45	1	10	1	10
59	16	3	1	22	17	2	22	1	13
75	14	2	1	19	45	3	17	1	02
64	17	3	1	16	76	2	19	1	14
478	04	1	0	10	1150	2	01	1	00

Let it be required to add up the Sum above, expressing *£*, *s*, *d*, and *q*. First, add up the Pounds by making a Speck or Tittle at every 28 you find in the place of Pounds, as you may see in the above-mentioned Example, where is found to be six specks, and 10 lb over, which 10 place under the Denomination of Pounds, and carry 6 to the Quarters, and add them up, they make 24, which is 6 *s*. for which put a (o) under the place of *q*s, and carry 6 *s*. to the place of *s*. Then proceed to add up your *s*. after the same manner as you carry from Shillings to Pounds, because 20 *s*. make a *£*. Lastly, add up the *£*s, and the Total will appear to be 478 *£*. 04 *s*. 0 *d*. 10 *q*.

With *Troy Weight* are weighed Bread, Gold, Silver, and Elestusies. And with *Averdupois Weight* are weighed Butter, Cheese, Flesh, Wax, Tallow, Pitch, Rozen, Lead, Iron, all sorts of Grocery Wares, and all such kind of garble whence there may issue a waste.

The Pound *Averdupois*, containing 16 Ounces, is equal to 14 oz. 12 *pw*. *Troy Weight*. And the Pound

Pound Troy Weight, consisting of 12 Ounces, is about 13 Ounces 2 Drams and a half of *Averdupois Weight*; so that he who tells you a Pound of Bread is as heavy as a Pound of Cheese is very much mistaken, the one being a Pound Troy, and the other a Pound *Averdupois Weight*.

WOOL is also weighed with *Averdupois Weight*, but the Divisions are somewhat different, viz. for Wool.

7 Pounds is a Clove, 2 Cloves is a Stone, 2 Stone is a Tood, 5 Toods 1 Stone 12 Stone is a Wey, 2 Weys is a Sack, and 12 Sacks is a Last of Wool.

Note, That according to the foregoing Division, 182 lb. is a Wey, but in some Countries the Wey is 256 lb. *Averdupois*, as in Suffolk, &c. And in Essex there is 336 lb. in a Wey.

Addition of Apothecaries Weights.

Apothecaries Weights are the same in the main with *Troy Weight*, only the Subdivisions of the Pound are different, as followeth, viz.

Note, That 20 Grains is a Scruple, 3 Scruples is a Dram, 8 Drams is an Ounce, and 12 Ounces is a Pound Weight. The Marks or Characters by which Apothecaries Weights are known are these, viz. for Pounds (lb.) Ounces (℥) Drams (ʒ) Scruples (ʒ) and Grains (gr.)

lb.	℥.	ʒ.	ʒ.	gr.
76	: 09	: 2	: 0	: 15
54	: 10	: 5	: 2	: 17
68	: 11	: 7	: 1	: 13
28	: 04	: 4	: 1	: 12
16	: 10	: 0	: 2	: 18
35	: 06	: 1	: 0	: 14
281	: 04	: 6	: 1	: 09

Addition of Troy Weight.

Note, That 24 Grains is a Penny-weight, 20 Penny-weights is an Ounce, and 12 Ounces is a Pound Troy weight.

The Notes or Characters by which Troy weight is known are these, viz. The Mark of Pounds is (lb.) of Ounces (oz.) of Penny-weights (pw.) of Grains (gr.)

Let it be required to add the following particulars together, viz. 24 lb. 09 oz. 06 pw. 11 gr. and 164 lb. 10 oz. 14 pw. 18 gr. and 82 lb. 7 oz. 17 pw. 20 gr. and 8 lb. 11 oz. 18 pw. 22 gr.

Now

Now, in order to find out the Sum of these given Quantities, I place them one under the other orderly, as you see in the Margent, and draw a Line under them. Then

I begin with the Denomination of Grains, making a prick with the Pen at every 24 (for ease) and bear the overplus to the next above, saying, 22 and 20 is 42 which is 18 above 24, wherefore I make a Mark at 20, and

lb.	oz.	pw.	gr.
24	: 09	: 06	: 18
164	: 10	: 14	: 18
82	: 07	: 17	: 20
8	: 11	: 18	: 22
281	: 03	: 17	: 23

carry the 18 up higher, saying, 18 and 18 is 36, which is 12 above 24, wherefore I make a Mark at 18, and carry the 12 to the next above, saying, 12 and 12 make 24, which I put under the Line in its proper place, and observe how many Pricks I have made in the casting up this Denomination, which I find to be 2, wherefore I carry 2 to the next, and proceed (as in the Shillings in Addition of Money, because I carry 1 for every 20) saying, 2 and 8 is 10, and 7 is 17, and 4 is 21, and 6 is 27, and (then down again with the Tens) 20 is 37, and 10 is 47 and 10 is 57 Penny-weight, which is 2 oz. 17 pw. wherefore I put 17 pw. in its place under the Line, and carry the 2 oz. saying, 2 that I carry and 1 is 3, and 7 is 10 and 10 is 19, and 10 is 29, and 10 is 39 Ounces, which is 3 lb. 3 oz. wherefore I put the 3 Ounces in its proper place under the Line, and carry the 3 lb. to the Pounds, and proceed to finish the Work as before is directed, which being done, I find the total Sum to be 281 lb. 3 oz. 17 pw. 23 gr. as in the Margent.

More Examples for Practice follow.

lb.	oz.	pw.	gr.	lb.	oz.	pw.	gr.
379	: 05	: 14	: 18.	297	: 10	: 07	: 13.
168	: 11	: 17	: 14	768	: 09	: 14	: 06
794	: 09	: 10	: 22.	635	: 11	: 18	: 21.
634	: 10	: 18	: 20.	74	: 08	: 18	: 19.
75	: 06	: 11	: 15.	35	: 10	: 14	: 14.
34	: 00	: 06	: 16	24	: 06	: 16	: 18.
2087	: 09	: 09	: 09	1837	: 10	: 10	: 19

Addition of Liquid Measure.

The least Denomination in Liquid Measure is a Pint, which was heretofore deduced from a Pound Troy Weight, a Pound of Wheat Troy Weight making a Pint Liquid Measure, but in regard of the Disagreement thereof with the Rules of Solid Geometry in the gauging of Brewers Vessels, some taking 288 solid Inches for a Gallon, some 286, &c. it occasioned a difference between the Brewers and the Managers of His Majesties Excise, till the Parliament taking the Matter into Consideration, ordained that 282 solid Inches should make the Gallon of Beer Measure, and the Gallon being subdivided into 2 Pottles, each Pottle into two Quarts, and each Quart into 2 Pints, so that the Pint being the Eighth part of a Gallon, must contain 28 solid Inches and 7 eighth parts of an Inch for Wine Measure, and 35 solid Inches and a quarter for Beer Measure. Wherefore note, that 35 $\frac{1}{4}$ solid Inches make a Pint Beer Measure, 2 Pints is a Quart, a 2 Quarts is

is a Pottle, 2 Pottles or 282 solid Inches a Gallon, 8 Gallons is a Firkin of Ale, 9 Gallons is a Firkin of Beer, and 2 Firkins is a Kilderkin, and 2 Kilderkins is a Barrel, $1\frac{1}{2}$ Barrel, or 54 Gallons is a Hogshead of Beer.

In Wine Measures.

2 Pints is a Quart, 2 Quarts is a Pottle, 2 Pottles is a Gallon, 42 Gallons is a Tonne, or Third-part of a Pipe or Butt, 63 Gallons is a Hogshead, 2 Hogsheads is a Pipe or Butt, and 2 Pipes or Butts is a Tun of Wine.

& Note, Honey and Oyl are measured by this Measure.

Examples of Wine Measure.

T. bhd.	gal.	pts.	T. bhd.	gal.	pts.
37	: 3	: 18	: 5	240	: 1 : 48 : 3
48	: 2	: 24	: 0	196	: 3 : 22 : 1
67	: 1	: 20	: 6	97	: 3 : 51 : 9
38	: 2	: 17	: 7	85	: 2 : 17 : 6
79	: 0	: 47	: 3	43	: 0 : 25 : 0
64	: 1	: 52	: 4	93	: 1 : 38 : 5
335	: 3	: 55	: 1	757	: 1 : 14 : 4

Addition of Dry Measure.

The least Denominative part of dry Measure is a Pint, which is taken from Troy Weight.

With these are measured all dry Substances, as Corn, Salt, Coal, Sand, &c. The Table followeth.

In Dry Measure, Note that 2 Pints make a Quart, 2 Quarts a Pottle, 2 Pottles a Gallon, 2 Gallons a Peck, 4 Pecks a Bushel Land Measure, 5 Pecks a Bushel Water Measure, 8 Bushels a Quarter, 4 Quarters a Chaldron, and 5 Quarters a Wey.

Note, 36 Bushels is a Chaldron of Sea-Coal in London.

Examples of Dry Measure.

Chald. qurs. bush. pec.	Chald. qurs. bush. pec.
148 : 3 : 6 : 3	227 : 1 : 5 : 0
375 : 1 : 7 : 2	742 : 3 : 7 : 1
296 : 2 : 4 : 3	148 : 2 : 4 : 1
128 : 1 : 5 : 0	97 : 2 : 6 : 3
94 : 0 : 5 : 2	48 : 0 : 3 : 0
38 : 2 : 4 : 3	62 : 3 : 1 : 1
1082 : 1 : 2 : 1	1327 : 2 : 3 : 2

Addition of Long Measure.

Long Measure is originally deduced from a Barley-Corn taken out of the middle of the Ear and well dried, from whence is deduced the following Table, viz.

In Long Measure, Note, that 3 Barley-Corns make an Inch, 12 Inches a Foot, 3 Foot a Yard, 3 Foot 9 Inches, or a Yard and a Quarter, is an Ell English, 6 Feet a Fathom, 5 Yards and an half, or 16 Feet and an half, make one Statute Pole, or Perch, 30 Poles or Perches make a Furlong, and 8 Furlongs make an-English Mile.

Examples

Examples of Long Measure.

Miles	Fur.	Perch.	Miles	Fur.	Perch.
48	: 7	: 24	134	: 3	: 18
37	: 3	: 18	342	: 4	: 24
63	: 5	: 28	179	: 5	: 16
36	: 5	: 00	84	: 0	: 15
107	: 1	: 07	76	: 7	: 27
205	: 6	: 17	84	: 2	: 13
501	: 6	: 04	902	: 1	: 03

Addition of Cloth Measure.

Note, That 4 Nails, or 9 Inches make a quarter of a Yard, 3 quarters of a Yard make an Ell Flemish, 4 quarters a Yard English, 5 quarters of a Yard, or 45 Inches is an Ell English.

Examples of Cloth Measure.

yds.	qrs.	na.	Ells	qrs.	na.	Ell. fl.	qrs.	na.
137	: 3	: 3	376	: 2	: 0	184	: 1	: 2
295	: 1	: 2	178	: 3	: 3	357	: 2	: 1
112	: 2	: 3	742	: 3	: 1	475	: 2	: 2
215	: 0	: 1	99	: 2	: 2	251	: 1	: 0
174	: 1	: 2	84	: 1	: 2	164	: 0	: 2
764	: 3	: 0	68	: 0	: 3	87	: 1	: 3
1700	: 0	: 3	1547	: 3	: 3	1521	: 0	: 2

Addition of Land Measure.

From the foregoing Table of Long Measure, is also superficial Measure deduced, that of Land Measure being as followeth, viz.

In Land Measure, 40 Square Poles or Perches make a Rood, and 4 Roods make an Acre.

Examples of Land Measure.

<i>Acr. Rood. Per.</i>	<i>Acr. Rood. Per.</i>	<i>Acr. Rood. Per.</i>
120 : 2 : 34	164 : 1 : 20	320 : 3 : 10
275 : 3 : 14	130 : 3 : 25	180 : 1 : 19
162 : 1 : 35	644 : 2 : 17	672 : 3 : 28
98 : 2 : 20	563 : 0 : 24	191 : 0 : 12
47 : 3 : 30	372 : 3 : 18	634 : 1 : 16
64 : 1 : 15	140 : 1 : 26	87 : 2 : 14
769 : 3 : 28	2016 : 1 : 10	2087 : 0 : 18

Of Time.

The Denominative parts of Time are originally deduced from the Sun's Motion in the Heavens, which is carried round the same from East to West by the Rapid Motion of the *Primum Mobile* in one Day Natural, which Day is divided into 24 supposed equal parts, called Hours, and each Hour is subdivided into 60 Minutes, &c. whence ariseth the following Table, viz.

In Time, Note, That 60 Minutes make an Hour, 24 Hours make a Natural Day, 7 Days make a Week, 4 Weeks make a Month, consisting of 28 Days, 12 Months 1 Day and 6 Hours make a Year.

However,

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However in the ordinary Computation of Time, the Year is divided into 12 unequal Calendar Months, whose Names, and the Numbers of Days that each containeth, are as followeth, viz.

Days.	Days
January ———— 31	July ———— 31
February ———— 28	August ———— 31
March ———— 31	September ———— 30
April ———— 30	October ———— 31
May ———— 31	November ———— 30
June ———— 30	December ———— 31

Note, That the 6 odd Hours is reckoned but once in 4 Years, and the one whole day is added to that Year, making it to consist of 366 days, and is called *Leap-Year*; the said day is added to February, which then containeth 29 days.

Note also, That the Minute is usually subdivided into 60 Seconds, and each Second into 60 Thirds, &c.

The Tropical Year, or the time the Sun leaves the Tropick, till the time it returns to it again; by the Observations of the most Accurate Astronomers, is found to consist of 365 Days, 5 Hours, 49 Minutes, 4 Seconds, and 21 Thirds.

CHAP. III. Of SUBTRACTION.

SUBTRACTION Teacheth to take a lesser Number from a greater, or an equal from an equal; whereby we discover the Remainder Excess, or Difference.

B 5

II. In

II. *In Subtraction*, if the Numbers given be Integers, that is, consisting of one Denomination, then place the biggest Number uppermost, and the lesser in order under it, viz. Units under Units, Tens under Tens, Hundreds under Hundreds, &c. And draw a Line under them.

III. Then begin at the place of Units, taking the lowermost Figure out of the uppermost, and place the Remainder under the Line, then proceed to the place of Tens, and do in the same manner, and then to the place of Hundreds, &c. till the whole Work be finished : Then shall the Number under the said Line be the Remainder or Difference.

Example.

Let it be required to find the difference between 48 and 16.

First, I put down the biggest Number, 48, and place 16 the lesser Number under it, and under both I draw a Line, as you see in the Margent; then I begin at the place of Units, saying 6 out of 8 and there remains 2, which I place under the Line, and proceed to the next place, 16 saying, 1 from 4 and there remains 3, which I likewise place under the Line, and the Work is finished. So that I find the remainder or difference between 48 and 16 to be 32, as you may see by the Work in the Margent.

More Examples of the like nature follow.

From	743	586	3785	1842
Subtr.	121	270	205	342
Remains	622	316	3580	1500

But if the particular Figure which you are to *Subtract*, be greater than the Figure out of which it is to be *Subtracted*; then you are to borrow 10, and add it to the uppermost Figure, and then *Subtract* the said lowermost Figure, from their Sum, and place the *Remainder* underneath the Line, and for that which you borrowed, add 1 to the next Figure in the lowermost Line, and proceed. Let this be repeated as often as there is occasion.

Example.

Let it be required to Subtract 3872 from 43758.

The given Numbers being placed, and a Line drawn under them, as is before directed, I begin at the right Hand, saying 2 from 8, and there remains 6, which I set under the Line, and proceed, saying, 7 from 5 I cannot, 43758 but 7 from 15 and there remains 8, 3872 which I put under the Line, and proceed to the next, saying, 1 that I borrowed 39886 and 8 is 9 from 7 I cannot, but 9 from 17 and there remains 8, which I put under the Line, and proceed to the next Figure, saying, 1 that I borrowed and 3 is 4, from 3 I cannot, but 4 from 13 and there remains 9, which I put under the Line; now because there is no Figure stand-

standing under the 4, I therefore suppose a (o) Cypher to be placed there, and because I borrowed 1 at the last Figure, therefore I pay it here by Subtracting it out of the 4, saying, 1 that I borrowed out of 4 and there remains 3, which I put under the Line, and the Work is finished; and I find (after the Work of Subtraction is ended) the remainder to be 39886 : These Examples being well understood, will render what follows to be plain and easie.

From	7458	50876	10008576
Subtr.	467	947	8743
Remains	6991	49929	9999833
From	5100	30210	15764
Take	1754	10325	7276
Rest	3346	19885	8488
Proof	5100	30210	15764

The Proof of Subtraction.

For Proof of Subtraction, add the Rest, or Remainder, to the Number Subtracted, and if the Sum be equal to the uppermost Number (being the Number from whence Subtraction is made) your Work is true, otherwise false, as you may see in the last Example of Subtraction above mentioned.

Subtraction of Money.

IV. If the given Numbers consist of divers Denominations, such as *Money, Weight, Measure, Time, &c.* Then you are to place the lesser Number under the greater, in such sort that each Denomination may stand under its correspondent Name, as has been directed in *Addition*, and draw a Line under them.

Then proceed to Subtract the undermost from the uppermost, beginning at the least Denomination, and proceeding gradually towards the left hand, setting the *Remainder* of each Denomination under the Line until the whole be finished : As for Example.

Let it be required to Subtract 126*l.* 07*s.* 04*d.* $\frac{1}{4}$. from 254*l.* 13*s.* 10*d.* $\frac{3}{4}$. First, I place them down the lesser under the greater, and draw a Line under them, as you see in the Margent.

Then I begin at the right hand saying, 1 Farthing from 3 Farthings and there remains 2, which I put under the Line in the place of Farthings, and proceed to the Denomination of Pence, saying, 4 from 10 and there remains 6, which I put under the Line in the place of Pence, and then I go to the Denomination of Shillings, saying, 7 from 13 and there rests 6, which I put under the Line in the place of Shillings, and then I proceed to finish the Work according to the third Rule of this Chapter ; which being ended, I find the Remainder to be 128*l.* 06*s.* 06*d.* $\frac{1}{2}$. as you see in the Margent.

<i>l.</i>	<i>s.</i>	<i>d.</i>	
254	13	10	$\frac{3}{4}$
126	07	04	$\frac{1}{4}$
128	06	06	$\frac{1}{2}$

V. But

V. But if the lowermost Number in any of the Denominations chance to be greater than the uppermost, you must in such case borrow an Unit from the next greater Denomination, Subtracting the lowermost Number there from, and adding the Remainder to the said uppermost Number, and place that Sum under the Line; and then proceed, adding one to the next lowermost Number to the left hand for that you borrowed, &c.

A few Examples will make this Rule very plain.

			Let it be required to subtract
<i>l.</i>	<i>s.</i>	<i>d.</i>	178 <i>l.</i> 15 <i>s.</i> 9 <i>d.</i> $\frac{1}{4}$ from 348 <i>l.</i>
348	: 12	: 07 $\frac{3}{4}$	12 <i>s.</i> 7 <i>d.</i> $\frac{3}{4}$. First, I place
178	: 15	: 09 $\frac{1}{4}$	them down in order, as has
			been before directed, and
196	: 16	: 10 $\frac{1}{2}$	draw a Line under them. Then

I begin at the right hand with the Denomination of Farthings, saying, 1 from 3, and there remains 2, which I put under the Line, and proceed to the Denomination of Pence, saying, 9 Pence out of 7 Pence I cannot, but (borrowing one from the next Denomination, which is Shillings, and makes 12 Pence, I say) 9 from 12 and there remains 3, which I add to the 7 Pence and that makes 10 Pence, wherefore I put 10 Pence under the Line, and proceed to the next Denomination, which is Shillings, and say, 1 that I borrowed and 15 is 16 from 12 I cannot, but (borrowing 1 Pound from the next Denomination, which is 20 Shillings) 16 from 20 and there remains 4, which added to the said 12 makes 16 Shillings, which I set down under the Line, and proceed to the Pounds, saying, 1 that I borrowed and 8 is 9 from 8 I cannot, but 9 from 18, &c. And the Work being finished, I find the Remainder to be 169*l.* 16*s.* 10*d.* $\frac{1}{2}$ as appears by the Work in the Margent.

Exam-

Examples for Practice.

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
Received	295	11	03 $\frac{1}{4}$		415	00	05 $\frac{1}{4}$
Paid	107	14	09 $\frac{1}{2}$		107	11	08 $\frac{1}{4}$
Rest	187	16	05 $\frac{1}{4}$		307	08	08 $\frac{1}{4}$
Proof	295	11	03 $\frac{1}{4}$		415	00	05 $\frac{1}{4}$
Debtor	100	00	00		1072	01	05
Creditor	75	00	09		107	16	10 $\frac{1}{2}$
Balance	24	19	03		964	04	06 $\frac{1}{2}$
Proof	100	00	00		1072	01	05
Received	1010	10	10		100	00	09 $\frac{1}{2}$
Disburst	942	13	11 $\frac{1}{2}$		47	00	
Rest	67	16	10 $\frac{1}{2}$		52	19	11 $\frac{1}{2}$
Proof	1010	10	10		100	00	09 $\frac{1}{2}$

VI. If a Sum be lent, and Payment thereof made at several times in part, and you would know how much remains due, in this case you must add the several Payments into one Sum, and Subtract that Sum from the Sum lent, and the Remainder will shew how much is due. An Example or two will make it plain and easie.

Lent

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
Lent	3475	10	05		572	11	05
	358	14	07 $\frac{1}{2}$		154	09	07 $\frac{1}{2}$
	514	07	11 $\frac{1}{2}$		95	10	07
Paid at	294	16	09		6	14	05 $\frac{1}{2}$
several	344	10	08 $\frac{1}{2}$		72	11	04 $\frac{1}{2}$
times	365	15	10 $\frac{1}{2}$		16	17	02
	795	15	07 $\frac{1}{2}$		9	14	13 $\frac{1}{2}$
	462	14	08		164	17	09
Paid in all	3136	16	02 $\frac{1}{2}$		520	15	10 $\frac{1}{2}$
Rest due	338	14	02 $\frac{1}{2}$		51	15	06 $\frac{1}{2}$
Proo	3475	10	05		572	11	05

Examples.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
Lent	4768	17	10 $\frac{1}{2}$
Received	347	14	06 $\frac{1}{2}$
at several	785	11	18 $\frac{1}{2}$
times	128	15	09 $\frac{1}{2}$
	420	16	05
	124	00	02 $\frac{1}{2}$
Received in all	1806	18	11 $\frac{1}{2}$
Remains due	2961	18	11

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
Borrowed	3475	: 10	: 05		4620	: 00	: 00
Paid at several times	358	: 14	: 07 $\frac{1}{4}$		409	: 09	: 10
	514	: 07	: 11 $\frac{1}{4}$		276	: 15	: 07 $\frac{1}{4}$
	294	: 16	: 09		195	: 13	: 11 $\frac{1}{4}$
	344	: 10	: 08 $\frac{1}{4}$		167	: 19	: 10 $\frac{1}{4}$
	365	: 15	: 10 $\frac{1}{4}$		984	: 16	: 05 $\frac{1}{4}$
	792	: 05	: 06 $\frac{1}{2}$		785	: 07	: 06
Paid in all	2670	: 11	: 05 $\frac{1}{2}$		2820	: 03	: 02 $\frac{1}{4}$
Refts due	804	: 18	: 11 $\frac{1}{2}$		1799	: 16	: 09 $\frac{1}{4}$
Proof	3475	: 10	: 05		6420	: 00	: 00

Let us prove the Example of the Fifth Rule in Subtraction of Money, where it is required to Subtract 178*l.* 15*s.* 9*d.* $\frac{1}{4}$ from 348*l.* 12*s.* 7*d.* $\frac{3}{4}$.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
From	348	: 12	: 07 $\frac{3}{4}$
Subtr.	178	: 15	: 09 $\frac{1}{4}$
Remain	169	: 16	: 10 $\frac{1}{2}$
Proof	348	: 12	: 07 $\frac{3}{4}$

In this Example the Remainder is found to be 169*l.* 16*s.* 10*d.* $\frac{1}{2}$, which I add to 178*l.* 15*s.* 9*d.* $\frac{1}{4}$. (the Number given to be subtracted) and the Sum is 348*l.* 12*s.* 7*d.* $\frac{1}{4}$, which

is equal to the uppermost of the given Numbers, wherefore I conclude the Subtraction to be truly wrought.

Subtraction of Averdupois Weights.

A Salter buys 45 Tun, 7. C. 1 qr. 12 lb. of Log-wood, of which he sold 19 Tun, 14 C. 1 qr. 18 lb.

In order to the Work, I dispose of the given Numbers according to the Directions of the Fourth Rule of this Chapter, drawing a Line under them, as you see in the Example.

Tun.	C.	qr.	lb.
45	: 07	: 1	12
19	: 14	: 1	18
25	: 12	: 3	22

Then I begin at the right hand, which is pound weights, saying, 18 out of 12 I cannot, but 18 out of 28 (borrowing a qr. of a C. (which is 28 lb.) and there remains 10, to which add the 12 lb. it makes 22 lb. which I place under the lb, and carry 1 to the quarters, and say, 1 that I borrowed and 1 is 2, now 2 quarters, out of 1 I cannot, but 2 out of 4 quarters (which is a C. weight) there remains 2, to which add the 1 quarter, it makes 3, which I place under the qrs. and proceed to the C. and say, 1 that I borrowed and 14 C. is 15 C. now 15 C. out of 7 C. I cannot, but 15 C. out of 20 C. (which is 1 Tun) there remains 5, to which add the 7 C. it makes 12 C. which I place under the C. and pro-

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proceed to the Tuns, and say, 1 that I carried and 9 is 10, 10 out of 5 I cannot, but 10 out of 15, rest 5, and carry 1, and say, 1 that I carry and 1 is 2, out of 4 and there remains 2, and the Work is finished, and I find the Remainder or Difference to be 25 Tun, 12 C. 3 qrs. 22 lb.

More Examples for the Learners Practice.

	Tun.	C.	qr.	lb.		C.	qr.	lb.						
Bought	107	:	10	:	2	:	05		74	:	0	:	15	
Sold	94	:	17	:	3	:	10		19	:	1	:	11	
Rest	12	:	12	:	2	:	23		54	:	3	:	04	
Proof	107	:	10	:	2	:	05		74	:	0	:	15	

	C.		qrs.		lb.		C.		qrs.		lb.
Bought	194	:	3	:	27		454	:	1	:	17
Sold	99	:	2	:	16		196	:	3	:	22
Unfold	95	:	1	:	11		257	:	1	:	23
Proof	194	:	3	:	27		454	:	1	:	17

If several Quantities in *Gross Weight* be given, out of which you would Subtract the *Tare*, in such a case add the *Gross Weight* into one Total: And

And add the Tare likewise into one Total. Then Subtract the Total of the Tare from the Total of the Gross, the Remainder is *Nett* weight.

Example.

A Merchant sells 6 Hogsbheads of Sugar, viz.

	C.	qrs.	lb.		C.	qrs.	lb.
N ^o 1 Gr.	14	:	2	:	10		
2	17	:	1	:	19		
3	16	:	2	:	14		
4	17	:	1	:	10		
5	18	:	2	:	17		
6	14	:	1	:	22		
Gross	99	:	0	:	08		
Tare	12	:	3	:	24		
Rest Nett.	86	:	0	:	12		

Subtraction of Troy Weight.

	oz.	pw.	gr.		oz.	pw.	gr.
Bought	115	:	07	:	05		
Sold	94	:	13	:	10		
Rest	20	:	13	:	19		
Proof	115	:	07	:	05		

Bought

	lb.	oz.	pw.		lb.	oz.	pw.	gr.
Bought	375	: 05	: 13		194	: 3	: 09	: 16
Sold	196	: 10	: 17		95	: 7	: 14	: 18
Rem	178	: 06	: 16		98	: 7	: 14	: 22
Proof	375	: 05	: 13		194	: 3	: 09	: 16

I might proceed to give Examples in Subtraction of Liquid Measure, Dry Measure, Long Measure, Apothecaries Weights, Time, Motion, &c. but there being no more difference between the working of these and those Examples, than only observing the Tables of each, which are delivered in the second Chapter, therefore I forbear, this being sufficient for the meanest Capacity.

CHAP. IV.

OF MULTIPLICATION.

I. IN Multiplication there are always two Numbers given to find out a third, which shall contain either of the given Numbers as many times as the other containeth an Unit.

H. Of the two Numbers given, the one is called the *Multiplicand*, and the other is called the *Multiplier*, and the Number found out by the Operation is called the *Product*.

HL. The

III. The *Multiplicand* is the Number given to be Multiplied, and is usually, for orders sake, the biggest of the two given Numbers.

IV. The *Multiplier* is that by which the *Multiplicand* is Multiplied, and is usually the least Number.

V. The *Product* is the Number produced by the Multiplication, and it containeth the *Multiplier* as many times as the *Multiplicand* containeth Units; or it containeth the *Multiplicand* as often as the *Multiplier* containeth Units.

VI. *Multiplication* is either Simple or Compound.

VII. *Simple Multiplication* is when the *Multiplicand* and the *Multiplier*, do each of them consist of one single Figure only: As if it were required to multiply 4 by 3, 5 by 2, 9 by 7, &c. Were 3 times 4 is 12, and 2 times 5 is 10, and 7 times 9 is 63; now 12, 10, and 63, are the *Products* of each Multiplication.

VIII. All the variety of *Simple Multiplication* is contained in the following Table, which must be learned by heart, before the Learner can make any further Progress.

Multipli-

Multiplication TABLE.

1 times	2 is 2	3 is 3	4 is 4	5 is 5	6 is 6	7 is 7	8 is 8	9 is 9	10 is 10	11 is 11	12 is 12
2 times	4	6	8	10	12	14	16	18	20	22	24
3 times	6	9	12	15	18	21	24	27	30	33	36
4 times	8	12	16	20	24	28	32	36	40	44	48
5 times	10	15	20	25	30	35	40	45	50	55	60
6 times	12	18	24	30	36	42	48	54	60	66	72
7 times	14	21	28	35	42	49	56	63	70	77	84
8 times	16	24	32	40	48	56	64	72	80	88	96
9 times	18	27	36	45	54	63	72	81	90	99	108
10 times	20	30	40	50	60	70	80	90	100	110	120
11 times	22	33	44	55	66	77	88	99	110	121	132
12 times	24	36	48	60	72	84	96	108	120	132	144

IX. *Compound Multiplication* is when the *Multiplicand*, or *Multiplier*, or both of them, do consist of *Compound Numbers*, that is, of more Figures or Places than one.

As if it were required to Multiply 324 by 2, here the *Multiplicand* is 324, which consisteth of 3 places, and the *Multiplier* is 2.

X. When it is required to Multiply one Number by another, first set down the biggest Number for the *Multiplicand*, and under that the *Multiplier* in such order as has been taught in Addition and Subtraction, viz. Units under Units, Tens under Tens, &c. and draw a Line under them.

As if it were required to Multiply 324 by 2, I set them down as followeth, viz.

The Multiplicand	324
The Multiplier	2

Then I begin with the place of Units, saying, 2 times 4 is 8, which I put under the Line; then 2 times 2 is 4, which I also put under the Line; and 2 times 3 is 6, which I also put under the Line, and the Work is finished: So that I find 324 being Multiplied by 2, produceth 648, as by the following Work.

The Multiplicand	324
The Multiplier	2

The Product	648
-------------	-----

XI. When the Product of any single Figure amounts to 10, or a certain number of Tens, then you are to set down a Cypher, and carry an Unit for

for every Ten to the Product of the next Figure ; or if it comes to above 10, or any number of Tens, then set down the excess, and carry an Unit for every Ten, &c. as in the following Example.

Let it be required to Multiply 785641 by 5.

The Number being set down according to the Tenth-Rule, I begin, saying, 5 times 1 is 5, which I put under the Line, and proceed, saying, 5 times 4 is 20; wherefore I put down 0, and carry 2 for the 2 Tens to the next, saying, 5 times 6 is 30, and 2 that I carried is 32, wherefor I put down 2 and carry 3 from the 3 Tens to the next Figure, saying, 5 times 5 is 25, and 3 that I carried is 28, wherefore I put down 8, and carry 2 to the next, saying, 5 times 8 is 40, and 2 that I carry is 42, so I put down 2, and carry 4 to the next Figure saying, 5 times 7 is 35, and 4 that I carry is 39, which being the last Figure, I put down 39 under the Line, and so the Work is finished, and I find that 785641 being Multiplied by 5 the Product is 3928205, as appears by the whole Work in the Margent.

$$\begin{array}{r} 785641 \\ 5 \\ \hline 3928205 \end{array}$$

And here by the way, Note, That Multiplication is a Compendious Performance of Addition, for in the last Example, if instead of Multiplying 785641 by 5, I put down the Multiplicand 5 times in order one under the other, and add them all together, then will the Sum of them amount to the Product that was found by the foregoing Work of Multiplication, as appears by the Work in the Margent. The same may be performed by any other Example.

$$\begin{array}{r} 785641 \\ 785641 \\ 785641 \\ 785641 \\ 785641 \\ \hline 3928205 \end{array}$$

Other Examples for this Rule for Practice may be such as follow.

748046	570084	7115083
4	6	8
2992184	3420504	56920664
72190	35726	145796
9	3	10
649710	178630	1457960

XII. When the *Multiplier* consists of divers places, then must there be as many *particular Products* as there are places therein, and for the true placing of each *Product*, observe to put the first Figure or place of Units under its proper *Multiplier*, and when you have done, draw a Line under the whole Work, and add the *several Products* together, and their Sum will be the total *Product* required.

Example 1.

Let it be required to Multiply 46753 by 46.

Having placed the given Numbers in order to the Work, according to the Tenth Rule of this Chapter, and drawn a line under them, as you see in the Margent, I begin to Multiply with the 6, saying, 6 times 3 is 18, wherefore I put down 8 under the Line, and carry 1 to the next, saying, 6 times 5 is 30, and 1 that I carry is 31, &c. so that the *Product* by 6 is 280518. Then I begin with the 4,

46753
46
280518
187012
2150638

saying,

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saying, 4 times 3 is 12, wherefore I put down 2 (under the Line, and under the Figure 4 by which I Multiply) and carry 1 for the Ten to the next, saying 4 times 5 is 20, and that I carry is 21, wherefore I set down 1, and carry 2 to the next, &c. and I find the single Product by 4 to be 187012, and so the Multiplication is ended: Then I draw a Line under these two particular Products, and add them together in the order as they stand, and the Sum is 2150638, which is the true Product of 46753 being Multiplied by 46, that is, 46 times 46753, is 2150638, and is equal to the Sum of 46753, being set 46 times one under another and added together. Behold the whole-Work of Multiplication in the Margent.

Example II.

Let it be required to Multiply 5800846 by 478.

First, I dispose of the given Numbers in order to the Operation, according to the tenth Rule foregoing.

Then I begin and Multiply the whole *Multipl-*
cand by (the first Figure of the *Multiplier*) 8, and
the Product thereof is 46406768; then I Multiply
the same again by (the second Figure of the Multi-
plier) 7, and the Product thereof is
40605922, the first Figure where-
of, viz. 2, I place under the 7, by
which I Multiply. Then I proceed
to Multiply by 4, and the Product
thence arising is 23203384, the first
Figure whereof, which is 4 I place
under 4, by which I Multiply, and all
the rest in their order, and so the

C 2

$$\begin{array}{r}
 5800846 \\
 478 \\
 \hline
 46406768 \\
 40605922 \\
 23203384 \\
 \hline
 2772804988 \\
 \text{whole}
 \end{array}$$

whole Work of Multiplication is finished : Then I draw a Line under all, and add up the several Products, and their Sum is 2772804388, which is the total Product.

A General Rule in Multiplication, is chiefly to observe, That in whatsoever place the Figure of the Multiplier (whether a Cypher or Cyphers) stands from the place of Units, in the same place must the first Figure of that Multiplication be set from the Unit of the Multiplicand.

And since the greatest Difficulty in Multiplication arises from having a Cypher or Cyphers in the Multipliers, I shall endeavour to make it plain and easie by the following Examples.

Example I.

Where there is one or more Cyphers in the Multiplier betwixt significant Figures.

$$\begin{array}{r}
 (2) \\
 45793 \\
 507 \\
 \hline
 320551 \\
 2289650 \\
 \hline
 23217051
 \end{array}$$

$$\begin{array}{r}
 (1) \\
 8465008 \\
 4006 \\
 \hline
 50790048 \\
 3386003100 \\
 \hline
 33910822048
 \end{array}$$

In the first Example you see that the Cyphers are put at the same distance from the Unit of the Multiplicand that they stand in from the Unit of the Multiplier; as 4, the Fourth Figure of the Multiplier (the first Figure in that Multiplication, which is 2) is set in the Fourth place from the Unit of the Multiplicand.

Exam-

Example II.

Where the Multiplier hath one or more Cyphers to the right hand thereof.

$$\begin{array}{r}
 (1) \\
 546735 \\
 4620 \\
 \hline
 10934700 \\
 3280410 \\
 2185940 \\
 \hline
 2525915700
 \end{array}$$

$$\begin{array}{r}
 (2) \\
 7645932 \\
 48000 \\
 \hline
 61167456 \\
 30583728 \\
 \hline
 557004736000
 \end{array}$$

Or, You may Multiply by the significant Figures, neglecting the Cyphers (as in the second Sum) as if there were none, only to the Product annex as many Cyphers as there were Cyphers in the Multiplier.

Example III.

Where the Multiplicand and Multiplier have each of them Cyphers at the right hand

$$\begin{array}{r}
 (1) \\
 58400 \\
 750 \\
 \hline
 3304000 \\
 408800 \\
 \hline
 44384000
 \end{array}$$

$$\begin{array}{r}
 (2) \\
 438700 \\
 67000 \\
 \hline
 30709 \\
 26322 \\
 \hline
 293929000000
 \end{array}$$

Or, You may neglect the Cyphers (as in the second Sum) only to the Product annex as many Cyphers as there were Cyphers to the right hand of the Multiplicand and Multiplier.

XIII. When the *Multiplier* consists of a Unit in the highest place towards the left hand, and all the rest Cyphers towards the right hand, as 10, 100, 1000, &c. then is the whole Work performed by annexing the Cyphers of the Multiplier to the Figures of the Multiplicand; as in the following Examples.

$\begin{array}{r} 6507 \\ 1000 \\ \hline 6507000 \end{array}$	$\begin{array}{r} 6507 \\ 100 \\ \hline 650700 \end{array}$	$\begin{array}{r} 6507 \\ 10 \\ \hline 65070 \end{array}$
---	---	---

XIV. It is necessary for all such as would be dexterous and ready at Arithmetick, to learn to Multiply by these Compound Numbers following very readily at one Operation, viz.

Ex. Mult.	374967	Mult.	842958
by	11	by	12
	$\begin{array}{r} \hline \text{fa. } 6324637 \\ \hline 345786 \\ 110 \\ \hline \end{array}$		$\begin{array}{r} \hline \text{fa. } 10115496 \\ \hline 859427 \\ 120 \\ \hline \end{array}$
Product	$\begin{array}{r} \hline 38036460 \\ \hline 7504675 \\ 12 \\ \hline 90056100 \end{array}$		$\begin{array}{r} \hline \text{fa. } 103131240 \\ \hline 3217295 \\ 12 \\ \hline 38607540 \end{array}$

Here 574967 is Multiplied by 11 thus, 11 times 7 is 77, put down 7, and carry 7, and then 11 times 6 is 66, and 7 L. carry is 73, put down

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down 3, and carry 7, then 11 times 9 is 99, and 7 I carry is 106, put down 6; and carry 10, then 11 times 4 is 44, and 10 I carry is 54, put down 4, and carry 5, then 11 times 7 is 77, and 5 is 82, put down 2, and carry 8, then 11 times 5 is 55, and 8 I carry is 63, which put down, to the Product of 574967 multiplied by 11 is found to be 6324637.

In like manner to multiply 842958 by 12, say, 12 times 8 is 96, put down 6, and carry 9, then 12 times 4 is 60, and 9 I carry is 69, put down 9 and carry 6, and so proceed till you have gone through your Sum.

To Multiply any Number by 110, or 120, put down a Cypher, and Multiply as before.

Multiply by	423760 1200	Multiply by	543760 1200
Product	<u>466136000</u>		<u>fs. 652512000</u>

The Proof of Multiplication.

XV. When you would prove the Truth of your Work in Multiplication, first, with your Pen make a Cross, and then add the Figures of the Multiplicand together, not considering their value as to the places they possess, but as if they were all Units, casting away the Nines as often as may be, and put the last Remainder on the left side of the Cross made for that purpose, then likewise add the Figures in the Multiplier together, casting away the Nines as often as may be, and put the last Remainder on the right side of the Cross; then multiply these two Remainders one by another,

G 4

ther,

ther, and cast away all the Nines out of their Product, and put their remainder above the Cross; then add together the Figures of the Product, casting away the Nines as often as may be, and put the last Remainder under the Cross, and then look if the Figure above the Cross, and the Figure below the Cross be equal, then is your Sum rightly performed, otherwise not.

As for Example: Let it be required to multiply 587464 by 465; when the Work is finished, I find the Product to be 273170760, as by the following Work appears.

$$\begin{array}{r}
 6 \\
 7 \div 6 \\
 6
 \end{array}
 \qquad
 \begin{array}{r}
 587464 \\
 465 \\
 \hline
 2937320 \\
 3524784 \\
 2349856 \\
 \hline
 273170760
 \end{array}$$

Now to prove whether the Work be rightly perform'd, I first make a Cross as you see above, and then begin to add the Figures of the *Multiplicand* together, saying, 5 and 8 is 13, cast away 9 and there rests 4; then 4 and 7 is 11, cast away 9 and there rests 2; then 2 and 4 is 6, and 6 is 12, cast away 9 and there remains 3; then 3 and 4 is 7, which I put down on the left side of the Cross: Then I add together the Figures of the *Multiplier*, as I did those of the *Multiplicand*, and the last Remainder there is 6, which I put on the right side of the Cross; then do I multiply these two Figures together which stand on each side of the Cross, viz. 6 and 7, and their Product is

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42, out of which I cast the Nines as often as may be, and there remains 6, which I put on the top of the Cross. But the easiest way to cast the Nines out of any Number, is to add the Figures together which constitute that Number, and their Sum is the Remainder when the Nines are cast away as often as may be, so in this Example the Nines are easily cast out of 42 (which is the Product of 6 by 7) for 42 is constituted of 4 and 2, whose Sum is 6; but if the said Sum chance to come to more than 9, cast 9 out of it, and put down the Remainder, so 8 times 7 is 56, the Sum of which Figures (5 and 6) is 11, out of which taking 9 there rests 2, which is the true Remainder when the Nines are cast out of 56 as often as may be.

Now in this Example, having put the said Remainder 6 above the Cross, I proceed to cast away the Nine out of the Product, and there remains 6 likewise, which I put below the Cross, and because the Figure above and below the Cross are equal, viz. each 6, I conclude the Work to be truly performed.

But the true Proof of Multiplication is by Division, as shall be taught in that Rule, this way by casting away the Nines many times proving the Work to be true, when it is absolutely false, but when it proveth not true this way, the Sum cannot be right.

C H A P. V.

O F D I V I S I O N.

DIVISION Teacheth to Divide any given Number into as many equal parts as you please.
Or,

It is that by which we discover how often one Number is contained in another.

II. In Division there are always 3 Numbers certain, and a fourth accidental.

III. Of the 3 Numbers certain two are always given to find out a Third, viz. The one of the Numbers given is to be *Divided*, the other Number given, is that by which the first is *Divided*, and the Number found out is the *Quotient*, and discovers how often the one Number is contained in the other.

IV. Therefore in this Rule are three remarkable Numbers, viz. The *Dividend*, the *Divisor*, and the *Quotient*.

(1.) The *Dividend* is the Number given to be divided into equal parts.

(2.) The *Divisor* is the Number given by which the *Dividend* is to be divided, which declareth into how many equal parts the *Dividend* is to be divided.

(3.) The *Quotient* is the Number Invented by the Operation, and shews how often the *Divisor* is contained in the *Dividend*.

And the *Remainder* is the Number which remains after the *Division* is ended, which is uncertain; and is the Fourth accidental Number, I mentioned before.

As

As suppose 15 were given to be divided by 3, or 15 Shillings to be divided amongst 3 Men, here 15 is the *Dividend*, 3 is the *Divisor*, and 5 is the *Quotient*, for 3 is contained in 15 just 5 times, without any Remainder; but if you were to divide 20 by 3, the *Quotient* would be 6, and the *Remainder* 2, for 3 is contained in 20, 6 times, and 2 remains over.

In *Division (by one Figure)* you are first to write down the *Dividend*, and then draw a crooked Line, and place the *Divisor* on the left hand thereof, then draw a Line under the *Dividend*, under which place your *Quotient*.

Example.

Let it be required to Divide 45 by 9, here the *Quotient* is 5, because 9 is contained in 45, 5 times, and these ought to be placed as followeth.

	Dividend.
Divisor 9)	45
Quotient	5

V. When a Number is given to be divided by a *single Figure or Digit*, if the first Figure of the *Dividend*, viz. (that on the left hand) be bigger, or at least equal to the *Divisor*, you are to put a Point or Prick under the same, and then proceed as followeth.

Example.

Suppose it were required to divide 6788 by 4, the given Numbers are placed as before directed, making

making a Prick under (6) the first Figure of the *Dividend*, which for distinction sake may be called the *Dividual*, as followeth.

	<i>Dividend</i>
<i>Divisor</i> 4)	6788
<i>Quotient</i>	1697

Note, In every *Division* you are to observe this Method; first, to *Seek*, secondly, to *Multiply*, thirdly, to *Subtract*.

As in the last Example, after you have writ down your *Dividend* and *Divisor*, as was shewed you, first, seek how often (or how many times) 4, which is the *Divisor*, can you have in 6, which is the first Figure of the *Dividend* towards the left hand, the Answer is once; which 1 place in the *Quotient* exactly under the 6 (as you see in the Operation of the Sum) and say, once 4 out of 6, there will remain 2, which 2 is two Tens to the next Figure 7; and makes the new *Dividual* 27. Then ask again (or *seek*) how often 4, the *Divisor*, can you have in 27, Answer, 6 times, which 6 place in the *Quotient* under 7, the second Figure of the *Dividend*, then take 6 times 4 which is 24 out of 27, there will remain 3, which is three Tens to 8, the third Figure of the *Dividend*, and makes it 38. Then ask again, how many times 4 can you have in 38? Answer, 9 times; which 9 place in the *Quotient* under 8, the third Figure of the *Dividend*; then take 4 times 9, which is 36, out of 38, there will remain 2, which is two Tens to the fourth and last Figure of the *Dividend*, and makes the 8 to be 28. Then *Lastly*, seek how often the *Divisor* 4 can you have in

in 28; Answer, 7 times, which I place under 8 the last Figure of the Dividend, and your Work is done; the Quotient being found to be 1697, which is the Number of times the Divisor 4 is found in the Dividend 6788. Or if the said Sum were to be divided between 4 Men, each Man's Share would be 1697 Pounds.

But to make this plain to any ordinary Capacity, I shall take the Dividend into pieces, to shew the four several Operations of the last Sum, and then give you some Examples for your Practice therein.

	Dividend				
Divisor 4)	6788				
	— 4)	6	27	38	28
Quotient	1697	—	—	—	—
		1	6	9	7

If you take 1 time 4 out of 6, there will remain 2 to the second Figure 7, which makes it 27; then 4 in 27, there will be 6 times, and 3 will remain to the third Figure 8, which makes it 38; then 4 in 38, there will be 9 times, and 2 will remain to the fourth Figure, which is 8, and makes it 28; then 4 in 28, is 7 times, which place under 8, the last of your Dividend, and your Quotient will be 1697.

Examples for the Learners Practice.

(1)	(2)	(3)
5) 712640	6) 721494	7) 42165
—	—	—
142528	120249	6023 1/2

VI. If you cannot take the Divisor out of the Dividend, as in the second Example, then are you to put a Cypher in the Quotient, and reckon that Figure as so many Tens to the next, as before was shewed you in the last Rule.

Example.

$$\begin{array}{r} 6 \overline{) 721494} \\ \underline{120249} \end{array}$$

Say, 6 in 7 once, rest 1, which makes the 2 12; then 6 in 12, 2 times; then 6 in 1, 0 times, rest 1, which makes the 4, 14; then 6 in 14, 2 times, rest 2, which makes the 9, 29; then 6 in 29, 4 times, rest 5, which makes the 4, 54; then 6 in 54, 9 times, so the Quotient is 120249.

VII. If after you have divided, there remains any thing, that which remains is called a Fraction, and must be placed at some distance from the last Figure of the Quotient in a lesser Character, then draw a small stroke under it, and place your Divisor under, as in the Examples following.

$$\begin{array}{r} (4) \\ 7 \overline{) 54934} \\ \underline{7847} \frac{1}{2} \end{array} \quad \begin{array}{r} (5) \\ 8 \overline{) 316495} \\ \underline{39561} \frac{1}{2} \end{array} \quad \begin{array}{r} (6) \\ 9 \overline{) 314256} \\ \underline{34917} \frac{1}{3} \end{array}$$

VIII. To prove your Division, Multiply your Quotient by the Divisor, to which add the Remainder; if the Product be the same as your Dividend is, your work is true.

$\begin{array}{r} 8) 85436 \\ \hline 10679 \frac{1}{2} \\ \hline \text{Proof } 85436 \end{array}$	$\begin{array}{r} 7) 364153 \\ \hline 52021 \frac{5}{7} \\ \hline 364153 \end{array}$	$\begin{array}{r} 9) 314254 \\ \hline 34917 \frac{2}{9} \\ \hline 314254 \end{array}$
---	---	---

To prove this last Example, where I divide by 9, I multiply 7, the Unit of my Quotient, by 9, the Divisor, which makes 63, and the remainder I added to it, makes 64; so I put 4, and carry 6, and say, 9 times 1 is 9 and 6 is 15, 5 and carry 1; then 9 times 9 is 81 and 1 I carry is 82, 2 and carry 8; then 9 times 4 is 36 and 8 is 44, 4 and carry 9; then 9 times 3 is 27 and 4 is 31, which put down, so the Product is 314254, the Sum equal with the Dividend, which was to be proved.

IX. But if the first Figure of the Dividend towards the left hand, be lesser than the first Figure of the Divisor, as in the Fifth and Sixth Examples of the Seventh Rule; then make the two first Figures your Dividend, and proceed as before.

Other Examples of Division by the foregoing Rules, without their Proofs.

$\begin{array}{r} 9) 51376 \\ \hline \text{Quot. } 5708 \frac{4}{9} \\ \hline \text{Proof } 51377 \end{array}$	$\begin{array}{r} 11) 413795 \\ \hline 37617 \frac{8}{11} \\ \hline 413795 \end{array}$	$\begin{array}{r} 12) 413271 \\ \hline 34439 \frac{3}{12} \\ \hline 413271 \end{array}$
--	---	---

To Divide by 11, say, 11 in 41, 3 times, rest 8, which makes the 3, 83; then 11 in 83, 7 times, rest 6, which makes the 7, 67; then 11

in 67, 6 times, rest 1, which makes the 9, 19; then 11 in 19, 1 time, rest 8, which makes the 5, 85; then 11 in 85, 7 times, the remainder is 11, so the Quotient is 37617 $\frac{11}{11}$.

And after this manner you may divide any Number by 12, 120, or 1200, as in the following Examples, the Multiplication Table being so composed, as to assist you in the multiplying and dividing by 11 and 12 as readily as by any other single Figure.

X. To divide any Number by 10, 100, or 1000, as many Cyphers as you have in your Divisor, cut off so many Figures from the Unit of your Dividend, as in the following Examples.

$$\begin{array}{r} 1|0) 4150|7 \\ \hline \text{Quot. } 4150 \frac{7}{10} \end{array} \quad \begin{array}{r} 1|00) 3142|67 \\ \hline 3142 \frac{67}{100} \end{array} \quad \begin{array}{r} 1|000) 91437 \\ \hline 91 \frac{437}{1000} \end{array}$$

XI. But if the Figure of the Divisor be more than a Unit, and Cyphers follow it, in such case, as many Cyphers as you have in the Units of your Divisor, cut off so many Figures from the Unit of your Dividend, and proceed to divide as in single Figures.

$$\begin{array}{r} 7|0) 5432|6 \\ \hline \text{Quotient } 776 \frac{6}{7} \\ \hline \text{Proof } 54326 \end{array} \quad \begin{array}{r} 3|00) 84295|67 \\ \hline 28098 \frac{67}{100} \\ \hline 8429567 \end{array}$$

Various

Various Examples for the Learners Practice.

11 0) 372045 6	12 0) 412678 5
Quotient <u>33822</u> $\frac{36}{100}$	<u>34389</u> $\frac{105}{100}$
Proof <u>3720456</u>	<u>4126785</u>
11 00) 62149675	12 00) 814653 70
Quotient <u>56499</u> $\frac{775}{1000}$	<u>67887</u> $\frac{270}{1000}$
Proof <u>62149675</u>	<u>81465370</u>

Division by two or more Figures, being the hardest Lesson in Arithmetick, must be heedfully attended by the Learner, for whose Ease I shall endeavour to make the way smooth, both by Rules and Examples.

XII. When the Divisor consisteth of more places than one, then you are to set out so many Figures on the left hand of the Dividend for a Dividual, and then put a point under that Figure of the Dividual which stands next to the right hand.

Then seek how often the first Figure towards the left hand of the Divisor, is contained in the first Figure towards the left hand of the said Dividual, and place the Answer in the Quotient.

Then Multiply the whole Divisor by the said Figure, so placed in the Quotient, and place the Product in order under the Dividual.

Which being done, subtract the said Product from the Dividual, placing the Remainder below the Line.

Then

Then put a Point under the next *Figure* of the *Dividend*, and annex it to the *Remainder*, so have you a new *Dividual*, with which you are to proceed as is before directed.

Example 1.

Let it be required to Divide 8904 by 42. Here the given Numbers being disposed of according to the Fourth Rule of this Chapter, will stand as followeth.

$$42) 8904 ($$

Then because there are 2 places in the Divisor, I take the two first Figures on the left hand of the Dividend for a Dividual, which is 89, putting a Point under the 9, which is that Figure of the Dividual which stands next to the right hand.

Then I seek how often the first Figure (4) of the Divisor, is contained in the first Figure (8) of the Dividual, and the Answer is 2 times, wherefore I put 2 in the Quotient, and thereby I multiply the Divisor 42, and the Product is 84, which I place in order under the Dividual 89, and subtract it therefrom, and the remainder is 5.

Then I put a Point under the next place, which is (0), and annex to the said remainder 5, and it makes 50 for a new Dividual, and then the Work will stand as followeth.

$$\begin{array}{r} 42) 8904 (2 \\ \underline{84} \\ 50 \end{array}$$

In

In the next place I seek how often I can have the first Figure of the Divisor (which is 4) in the first Figure of the Dividual 50 (which is 5) and the Answer is 1 time, wherefore I put 1 in the Quotient, and thereby multiply the Divisor 42, and the Product is 42, which I place in order under the Dividual 50, and Subtract it therefrom, and the remainder is 8, which I place in order under the Line, and thereto annex the next Figure of the Dividend, which is 4, (having first put a Point under it) and it makes 84 for a new Dividual, and then the Work will stand as followeth.

$$\begin{array}{r}
 42 \quad 8904 \quad (212 \\
 \underline{84} \\
 50 \\
 \underline{42} \\
 84 \\
 \underline{84} \\
 0
 \end{array}$$

3. Then I again seek how often the first Figure of the Divisor (which is 4) is contained in the first Figure of the Dividual (which is 8) and the Answer is 2 times, wherefore I put 2 in the Quotient, and thereby multiply the Divisor 42, and the Product is 84, which I place orderly under the Dividual 84, and subtract it therefrom, and there remains 0. So is the Operation ended, and I find that 8904 being divided by 42, the Quotient is 212, as by the foregoing Operation appeareth.

XIII: When you have multiplied The Divisor by the Figure placed in the Quotient, if the Product chance to be greater than the Dividual, then you may be sure that the Figure placed in the Quotient is too much; wherefore in such case you must cancel that Figure, and in the room thereof put one that is less by an Unit, and if the Product be yet bigger than the Dividual, place yet a lesser Figure than that in the Quotient, and then proceed as has been before directed.

Example 2.

Let it be required to divide 7868 by 37. The given Numbers being placed according to former Direction, I begin the Work, and first I seek how often I can have 3 (the first Figure of the Divisor) in 7 the first Figure of the Dividual 78, (having before put a point under the 8,) and the Answer is 2 times, wherefore I put 2 in the Quotient, and thereby multiply the Divisor 37, and the Product is 74, which being Subtracted from the Dividual 78, there remains 4, to which having annexed the next Figure of the Dividend (6) it makes 46 for a new Dividual. Then I proceed to seek how often 3 is contained in 4, and the answer is 1 time, wherefore I put 1 in the Quotient, and thereby multiply the Divisor 37, and the Product is 37, which being subtracted from the Dividual 46, the remainder is 9, to which the next Figure of the Dividend being annexed, viz. 8, it makes 98 for a new Dividual. Then I proceed to seek how often I can have 3 in 9, and the answer is 3 times, wherefore I put 3 in the Quotient, and thereby I multiply the Divisor 37, and the Product is 111, which is more than

than the Dividual, whereby I perceive that I have put a Figure too big in the Quotient; therefore according to the directions given in the foregoing Rule, I cancel the 3, and instead thereof I place a 2, and then multiply the Divisor thereby, and the Product is 74, which is lesser than the Dividual, wherefore I make Subtraction and there remains 24; and so having never another Figure to bring down from the Dividend, I conclude the work to be ended, and the Quotient thus found is 212, as by the following Operation appears.

2d. Examp. $37)7868(212$

$$\begin{array}{r}
 74 \\
 \hline
 46 \\
 37 \\
 \hline
 98 \\
 \text{xxx} \\
 74 \\
 \hline
 \end{array}$$

Remainder (24)

And here note, that if at any time it so happens, that after you have multiplied the Divisor by the Figure last placed in the Quotient, and Subtracted the Product from the Dividual, if the Remainder be greater than the Divisor, the Figure last placed in the Quotient is too little, and therefore it must be cancelled, and a bigger Figure placed in its room. What is to be done with the remainder after Division is ended, shall be shewed in its due place, but only for the present let it suffice to understand, that it is the Numerator

merator of a Fraction which is part of the Quotient, the Divisor being the Denominator to the same; So the true Quotient of the last Division is $212 \frac{1}{4}$. But more of this hereafter.

XIV. *When (according to the Directions given in the last Rule) you have assigned your Dividual to consist of as many Places as the Divisor containeth places, if then the Dividual be less than the Divisor, (so that the Divisor cannot be Subtracted therefrom) you are then to annex another Figure thereto, so that then it will consist of one place more than the Divisor hath places, and then you are to seek how often the first Figure of your Divisor is contained in the two first Figures of the Dividend; and then proceed according to the Rules before delivered.*

The like is to be observed in the middle of your Work, if the Dividual chance to consist of one Figure more than the Divisor, as in the following Example.

Example 3.

Let it be required to divide 4763585 by 587. Here, because the Divisor 587 consisteth of 3 places, therefore I should take the 3 first Figures to the left hand of the Dividend for a Dividual, which is 476, but because 476 is lesser than the Divisor 587, I therefore put another Figure thereto, and then I have 4763 for a Dividual, and having first put a point under the Figure 3, I begin the Division, and first I seek how often 5 (the first Figure) of the Divisor, is contained in 47 (the two first Figures of the Dividend) which I find to be 9 times, but having tryed according

to the Thirteenth Rule of this Chapter, I find 9 is too much, but it will bear 8, wherefore I put 8 in the Quotient, and having multiplied the Divisor thereby, and Subtracted the Product from the Dividual, according to the Direction given in the Twelfth Rule of this Chapter, I find the remainder to be 67, to which I annex the next Figure of the Dividend, which is 5, having first put a Point under it (according to the said Twelfth Rule) and then I have 675 for a new Dividual. Then I seek how oft 5 (the first of the Divisor) is contained in 6 (the first of the Dividend) and the answer is 1, which I put in the Quotient, and having Multiplied and Subtracted, I find the remainder to be 88, to which annexing the next Figure in the Dividend, it makes 888 for a new Dividual, then I seek, &c. And after Subtraction there is a Remainder of 301, to which annexing the next and last Figure of the Dividend, which is 5, it makes 3015 for a Dividual, which consisteth of one place more than the Divisor, therefore according to the latter part of the Fourteenth Rule, I seek how often 5 is contained in 30, and by tryal according to the Tenth Rule, I find it will bear 5 times, wherefore I put 5 in the Quotient, and having Multiplied and Subtracted, I find the Remainder to be 80, and the work is ended, and I find the Quotient to be $8115\frac{2}{3}$. See the following Work.

3d. Exam. $587 \overline{) 4763985}$

$$\begin{array}{r}
 4696 \\
 \hline
 675 \\
 587 \\
 \hline
 888 \\
 587 \\
 \hline
 3015 \\
 2935 \\
 \hline
 080 \text{ Remainder.}
 \end{array}$$

4 Exam. Divide 72164375 by 9437.

$$\begin{array}{r}
 9437 \overline{) 66059000} \quad (7046 \text{ Quot.} \\
 61053 \\
 56622 \\
 \hline
 44317 \\
 37748 \\
 \hline
 65695 \\
 56622 \\
 \hline
 \text{Remainder } 9073
 \end{array}$$

Thus have I run through one sort of Division, and I hope that by this time the Learner is able to divide any Number given, and here let him take notice once for all, that there must never be brought down but one Figure or Cypher at one time from the Dividend, to be annexed to the Remainder for a new

a new Dividual, and for every such Figure or Cypher so brought down, there must be a Figure or Cypher put in the Quotient.

I might give you many more Examples of Division, wherein the Divisor may consist of 4, 5, 6, 7, 8, 9, 10, &c. places, but the Method being the very same with what is before delivered, I shall therefore forbear, and only admonish the Learner to be perfect in the foregoing Rules, and to practice well the Examples therein delivered; and for further Practice, I shall give you the Quotients of four other Examples, but shall omit the Operation as a Whetstone for the Learners Ingenuity.

If you divide 2459337766 by 38462, the Quotient will be 63942, and the Remainder after the Work is finished 562.

And if you divide 4926735806877 by 5846793, the Quotient will be 842639, and there will be a Remainder of 150.

Or if you divide 1079245884216 by 1998573 the Quotient will be 540008, and there will be a Remainder of 475632.

Also if you divide 2395096414141498 by 297864, the Quotient will be 8040905964, and there will be a Remainder of 80602.

There is yet a much shorter way of Division, by omitting to set down the Multiplication of your Divisor, (as is done in the foregoing Examples) and in this you Multiply and Subtract together: In which way the Quotient is placed under the Divisor, as being most ready and convenient for the working of any Sum. And being the most accurate and ready Way of Division, I shall pursue this Method through the remaining part of this Book, after I have given three or

Four Examples of one and the same Sum divided by both ways for the Learners Ease and Practice.

Let us divide the two last foregoing Sums by the short *Italian* way of Division, viz. the third and fourth Examples.

First of all, Let be required to divide 476358 by 587, being the third Example.

First, I proceed and ask the Question, as was shewed you in the third Example of this Rule, and say, how often 5, the first Figure of the Divisor, can I have in 47, the first Figures of the Dividend? Answer, 8 times. Then Multiply 7, the Unit Figure of your Divisor, by 8, the Figure which you bring in your Quotient, and say, 8 times 7 is 56 out of 3 (the fourth Figure of the Dividend) I cannot, but 56 out of 63, rest 7, and carry 6 to the second Figure of the Divisor. Then Multiply again, and say, 8 times 8 is 64, and 6 I carried is 70, out of 6 I cannot, but 70 out of 76, rest 6, and carry 7 to the first Figure of the Divisor; then multiply again, and say, 8 times 5 is 40, and 7 I carried is 47 out of 47, rest 0. So that by this Operation you find after 8 times, 587 is taken out of 4763, there will remain 67, to which I take down 5, the next Figure of my Dividend, for a new Dividend.

$$\begin{array}{r} 587 \overline{) 4763585} \\ \underline{} \end{array}$$

$$\begin{array}{r} 8 675 \end{array}$$

Then I proceed again, and say, how often 587 (my Divisor) can I have in 675, my Dividend? The Answer is once, which I put in the Quotient, and Multiply as before, and say, once 7, out of 5 I cannot, but 7 out of 15 rest 8, and

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and carry 1; then once 8 is 8, and 1 is 9, 9 out of 7 I cannot, but 9 of 17, rest 8, and carry 1; then once 8 is 8, and 1 I carry is 6, 6 out of 6, there rests (0) which I omit to place down, because a (0) on the left hand is insignificant: Then to the Remainder 80 I take down 8, the next Figure of my Dividend, and it makes my new Dividend 888.

$$\begin{array}{r} 587 \overline{) 4763585} \\ \underline{81} 675 \\ 888 \end{array}$$

Then I proceed again, and ask, how often 587, my Divisor, can I take out 888, my Dividend, the answer is once, which 1 I put in the Quotient, and say, once 7 out of 8, rest 1; then once 8 is 8, 8 out of 8, rest 0; then once 5 out of 8, rest 3; so the Remainder of that Division is 301, to which I take down 5, the next figure of my Dividend, which makes my new Dividend 3015.

$$\begin{array}{r} 587 \overline{) 4763585} \\ \underline{81} 675 \\ 888 \\ 3015 \end{array}$$

Then I proceed and ask again, how often 587 I can have in my last Dividend 3015; the Answer is 5 times, which 5 I place in my Quotient and multiply as before, and say, 5 times 7 is 35, out of 5 I cannot, but 35 out of 35, rest, 0, and carry 3; then again, 5 times 8 is 40, and 3 I carry is 43, out of 1 I cannot, but 43 out of 51, rest

8

8, and carry 5; then lastly, 8 times 5 is 40, and 5 I carry is 30, 30 out of 40 rest 10. So my Remainder of this last Division is 10, which I cut off with a stroke from the rest of the Work to signify it to be a Remainder, and my whole Operation of the Sum stands as followeth.

Example 1.

$$\begin{array}{r} \text{Divisor } 587 \overline{) 4763585} \\ \text{Quotient } 8115 \quad \begin{array}{r} 675 \\ 888 \\ 3015 \end{array} \end{array}$$

Example II.

9437) Divide 72164375 by 9437.

Quotient	7646	61053
	56622	44317
	37748	65695
	56622	
	66059	9073
	72155302	
	9073	

Excerpt-

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Examples of the short Italian way of Division for the
Learners Practice, with their Proofs.

	297546)	1489751828835
Quotient	5006765	02021828
	297546	2363528
		2827063
	30040770	1491495
	20027180	
	25033975	03765
	35047565	
	45061155	
	10013590	

1489751825070

3765 Remainder.

1489751828835 Proof.
The same Examples after the long Italian way of Division, with their Proof.

297546)	1489751828835	(5006795
	1487730	

2021828

1785276

2363528

2082822

2827063

2677914

1491495

1487730

Remainder 3765

D 3

To

To prove your Division.

1. Multiply your Quotient by your Divisor (and to the Product add your Remainder, if any be) the Sum of all added together will be equal to your Dividend, if your Work be true. Or,

2. You may take the several Products that are placed under each Dividend (in this way of Division,) and place them in the same order as they there stand in respect to one another, and to their Sum add the Remainder, and the Proof will stand as followeth.

$$\begin{array}{r}
 1487730 \\
 1785276 \\
 2082822 \\
 2677914 \\
 1487730 \\
 \hline
 3765 \text{ Remainder} \\
 \hline
 1489751828735 \text{ Proof}
 \end{array}$$

O R,

You may also prove Division by casting out the Nines thus.

First make a Cross, then cast the Nines out of your Divisor, and place the remainder on the left side of the Cross. Then cast the Nines out of your Quotient, and place the remainder opposite to the other on the right side of the Cross; Multiply these two Figures together, and out of your Product cast the Nines, the overplus carry to the Remainder, and continue to cast out all the Nines therefrom, and the remainder above Nine place on the top of the Cross. Lastly, cast the Nines out.

out of your Dividend, and if that remainder comes to be the same Figure with that placed on the top, your Sum is true; then place that left Figure at the bottom of your Cross.

But the most certain Proof of Division (as I shew'd before) is by *Multiplication*; and the most certain Proof of *Multiplication* is by *Division*, they interchangeably proving each other.

For if you divide the *Product* by the *Multiplier*, the *Quotient* will be equal to the *Multiplied*.

If you divide the *Product* by the *Multiplier*, the *Quotient* will be equal to the *Multiplied*.

An Example or two will make this Proof of Division plain.

	(1)		(2)	
	Dividend.			
Divisor	734)	912673	457)	159137
	<u>1586</u>		<u>2203</u>	
Quotient	1210	787	348	3757
		<u>333</u>		<u>101</u>

In the first of these two last Examples my Divisor is 734, Quotient is 1210, Remainder is 333, and Dividend 912673. To prove which, make a Cross, as in the Margent: Then cast the Nines out of the Divisor, there will remain 7, which I place on the left side of the Cross, then cast the Nines out of the Quotient, rest 4, Multiply 7 by 4, it makes 28, cast out the Nines, rest 1, which I carry to the remainder, and say, 1 and 3 is 4, and 3 is 7, and 3 is 10, cast out 9, rest 1, which I place above the Cross.

$$\begin{array}{r} 1 \\ 7 \div 4 \\ 1 \end{array}$$

Lastly, cast the Nines out of your Dividend and there will rest 1, which place under the Cross and your Sum is true.

XV. When the Divisor consisteth of any other Number with a Cypher or Cyphers annexed thereto; then cut off the Cyphers of the Divisor with a dash of the Pen, and as many Cyphers as you cut off from the Divisor; so many places must you cut off from the Dividend; then proceed to Divide the remaining Figures of the Divisor, as if there were no such Cyphers or Figures in the Divisor or Dividend as you cut off, and if nothing remain after Division is ended, then shall the figures you cut off from the given Dividend be the true Remainder; but if any thing do remain after Division is ended, you are there to annex the figures of the Dividend that were before cut off, so shall the said remainder with the Figures annexed thereto be the true remainder.

Example.

Divide 486783 by 15000. First, I cut off the three Cyphers of the Divisor, and also three places of the right hand of the Dividend, so have I 15 for my Divisor, and 486 for my Dividend, viz.

$$\begin{array}{r}
 15 \overline{) 486793} \quad (32 \\
 \underline{45} \\
 36 \\
 \underline{30} \\
 6
 \end{array}$$

The

The same short way of Division.

$$\begin{array}{r} 15 \overline{) 000} \quad 486 \overline{) 793} \\ \underline{30} \qquad \underline{36} \\ 33 \qquad \underline{6} \end{array}$$

Here I find the *Quotient* to be 32, and the remainder is 6, to which annexing the Figures cut off from the *Dividend*, viz. 793, it makes 6793 for the true Remainder.

Having thus enlarged and finished the first Fundamental Rules of *Arithmetick*, their Application shall be more particularly taught in the following Chapters.

CHAP. VI.

OF REDUCTION.

I. **R**EDUCTION Teacheth to Reduce Numbers, whether Money, Weight, Measure, Time, Motion, &c. from one Denomination to another, discovering the same value, but in different Terms.

II. The whole Work of Reduction is performed by Multiplication and Division.

III. All great Denominations are brought into
 lesser of the same value by Multiplication, and
 this is by some called, **REDUCTION**
DESCENDING.

IV. All *small* Denominations are reduced into greater of the same value by *Division*;

and this is by some called **REDUCTION ASCENDING.**

V. To reduce greater Denominations into lesser of the same value, Consider how many of the Lesser are equal to one of the Greater, and multiply the given Number thereby, so shall the Product be the Answer to the Question.

Example.

Reduce 3468 Shillings into Pence.

3468 Here I consider that 12 Pence
12 is a Shilling, and the Pence ought to
be 12 times the number of Shillings,
for 41616 pence wherefore I multiply by 12 at one
Operation, according to the Fourteenth Rule of the fourth Chapter, and the Product is 41616 Pence, as in the Margent:

VI. To Reduce Smaller Denominations into Greater, Consider how many of the Smaller are equal to one of the Greater, and divide thereby, the Quotient is the Answer to the Question.

Example.

Reduce 41616 Pence into Shillings.

12) 41616
3468
for 3468 Shill.
First, consider that 12 Pence is a Shilling, and that the Shillings ought to be a twelfth part of the Pence; wherefore I divide the given Number by 12 at one Operation, as was shewed you in the Eleventh Rule of the Fifth Chapter.

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Chapter, and say, 12 in 48, 3 times, rest 5; to the 6 makes 18; then 12 in 36, 3 times, rest 8, which makes the 181; then 12 in 81, 6 times, rest 9, which makes the 696; then 12 in 96, is 8 times, and the Quotient gives me 3468 Shillings, which is the Answer to the Question, and may serve for a Proof of the foregoing Example.

Now, I would Advise the Learned to inure himself to the most short and ready ways of Multiplication and Division, which will very much contract the Operations in Reduction, viz. In Reduction of Money, to multiply the Shillings by 12 at one Operation as in Chap. 4. of Multiplication, Rule 14. And likewise to divide by 12 at one Operation, as in the 9th and 11th Rules of the fifth Chapter.

For your further assistance in Reduction, you ought to have respect to the Tables of Coin, Weight, Measure, &c. delivered in the second Chapter.

Example I.

In 685 L. I demand how many Shillings, Pence, and Farthings?

First, I multiply by 20 (because 20 Shillings is a Pound) and the Product is 13700 Shillings, then I multiply the Shillings, by 12 (because 12 Pence, is a Shilling) and the Product is 164400 Pence, then I multiply the Farthings by 4, because 4 Farthings is a Penny, and the Product is 657600 Farthings as in the Margent.

685 Pounds

20

13700 Shill.

12

164400 Pence.

4

for 657600 Pence

THE

This or any other number of *Pounds* might be reduced into *Pence* or *Farthings* at one Operation, without reducing it into the intermediate Denominations.

For if you multiply *Pounds* by 240 (because so many *Pence* make a *Pound*) the Product will be *Pence*; and if you multiply *Pounds* by 960 (because 960 *Farthings* is a *Pound*) the Product will be *Farthings*: So in the foregoing Example 685 *l.* being multiplied by 240, the Product you will find to be 164400 *Pence*; and if you multiply 685 *l.* by 960, the Product will be 657600 *Farthings*, for the Reasons before said.

20 *Shill.*

12

240 *Pence*

4

960 *Farth.*
one *Pound*.

960 *Farthings*, as in the Margin.

But you may say, you cannot well remember how many *Pence* or *Farthings* make a *Pound*, I will therefore teach you how to find it out at any time when you have occasion. You may easily remember that 20 *Shillings* is a *Pound*, and that multiplied by 12 produceth 240 *Pence*, which being multiplied by 4 produceth

Example II.

In 657600 *Farthings*, I demand how many *Pence* *Shillings*, and *Pounds*?

This Question is the Reverse of the former, and may serve for a Proof thereof: First, I divide the *Farthings* by 4, and the Quotient is 164400 *Pence*, then I divide the *Pence* by 12, and the Quotient is 13700 *Shillings*, and the *Shillings* I divide by 20, and the Quotient is 685 *Pounds*; which is equal to the given Number in the first Example: See the whole Operation as followeth:

4)

4) 652600 Farthings

12) 164400 Pence

20) 13700 Shillings.

Facit 685 Pound.

VII. When in Reduction Descending, the Number propounded to be reduced consisteth of divers Denominations, as of Pounds, Shillings, Pence, and Farthings, or of Pounds, Ounces, Penny Weights, and Grains, &c. then you may readily reduce it into the lowest Denomination, thus when you reduce an higher Denomination into the next inferior, add to the Product the expressed parts into which you reduce it, as if you were to reduce Pounds into Shillings, add to the Product (as you multiply) the Shillings, that are expressed in the Number propounded; proceed in the same method till ye have reduced the given Number into the Denomination required, as in the following Example.

Example III.

Reduce 367 l. 15 s. 6 d. $\frac{1}{4}$. into Farthings.

First, I multiply by 20 to bring into Shillings saying, 0 times 7 is 0; but 5 is 5, (taking in the 5 that is in the place of Units in the Rank of Shillings, and setting it in the place of Units in the Product;) then 2 times 7 is 14, and 1 is 15, (taking in the 1 that is in the place of Tens in the Rank of Shillings) so I set down 5 in the place of Tens in the Product, &c. the Product is 11355 Shillings; then I multiply the Shillings by

12 to bring them into Pence, saying, 12 times 3 is 60, and 6 is 66, (taking in the 6 that stands in the Rank of Pence,) &c. and the Pence, make 136266; then I multiply my Pence by 4 to bring them into Farthings, saying, 4, times 6 is 24, and 3 is 27, taking in the 3 which stands in the Rank of Farthings, &c. so the Farthings amount to 545067, as by the whole Operation appeareth

$$\begin{array}{r} 567 \text{ l.} - 15 \text{ s.} - 6 \text{ d.} \frac{1}{4} \\ 20 \end{array}$$

$$\begin{array}{r} 11355 \text{ Shillings.} \\ 12 \end{array}$$

$$\begin{array}{r} 136266 \text{ Pence.} \\ 4 \end{array}$$

$$\begin{array}{r} 545067 \text{ Farthings.} \end{array}$$

Observe the like in any other Example:

VIII. When in Reduction Ascending any thing remains after Division is ended, it is always of the same Denomination with the Dividend, as in the following Example.

Example IV.

Ar 545067 Farthings, I demand how many Pounds.

First, I divide the given Number of Farthings by 4, and the Quotient is 136266 Pence, and there remains 3, which is 3 Farthings, because the Dividend was Farthings.

Then

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Then I divide the Pence by 12, and the Quotient is 11355 Shillings, and there remaineth 6, which is 6 Pence, because the Dividend was Pence.

Then I divide the Shillings by 20, and the Quotient is 567 l. and there remaineth 15, which is Shillings, because the Dividend was Shillings: So that I find by the work, 543067 Farthings to be 567l. 15s. 6d. $\frac{1}{2}$ as by the following work.

$$4) 545067$$

$$12) 136266 \frac{1}{2}$$

$$20) 113515 : 6d.$$

$$\text{Facit lb. } 567. 15s. 6d. \frac{1}{2}.$$

This Question is the inverse of the Third Example, and may very well serve for a Proof thereof, as you may observe at your Leisure.

Here by the way take notice, that when you are (to divide any Number by 20, that is) to bring Shillings into Pounds, the best way is to cut off a Figure to the right hand for Shillings, and then to take half the Figures to the left hand for Pounds, and if one remain it is 10 Shillings to be added to the figure first cut off. For Example:

Where 11355 Shillings is to be reduced into Pounds, I cut off the last figure 5 for Shillings, and say, half of 11 is 5, half of 13 is 6, Half of 15 is 7, and there remains 1, which make the 5 Shillings to be 15 Shillings; and this Method shall be observed hereafter.

$$113515 : 5s. d.$$

$$\text{facit } 567-15-0$$

NOTE

NOTE once for all, That Reduction Ascending proves Reduction Descending, the one being a Reverse to the other, as shall be demonstrated in the ensuing Questions that follow over Leaf in all the Varieties of Reduction.

In 7642 l. 17 s. 11 d. $\frac{1}{4}$ I demand how many
20 (half Farthings.

152857 Shill.

12

1834295

8

for 14674361 half Farthings.

Tun. C. qr. lb.

Quest. 1. In 95 : 11 : 3 : 15 how many Pound

Averdupois } 20

(Weight?

Weight } —

1911 hundred

44

7647 quarters.

28

61181

152951

Facit 214131

Quest.

Chap. 6. Of Reduction Ascending. 89

Quest. 2. In 50 C. 2 gr. 15 lb. 9 oz. how many Ounces.

$$\begin{array}{r}
 4 \\
 \hline
 202 \\
 28 \\
 \hline
 1621 \\
 405 \\
 \hline
 5671 \\
 16 \\
 \hline
 34035 \\
 5671 \\
 \hline
 \end{array}$$

Facit 90745 Ounces.

By this you see that if 50 C. 2 gr. 15 lb. 9 oz. be Multiplied according to the Directions given in the 7th Rule of this Chapter, the Product will be 90745 Ounces, which is the Reverse or Proof of the second Question opposite to this on the right hand.

Quest. 1. In 214131 Pound Weight how many (Tuns ?

$$\begin{array}{r}
 28) \quad 181 \\
 \hline
 133 \\
 4) \quad 7647 \quad 211 \\
 \hline
 210) 1911 \frac{1}{4} \quad 15 \text{ Pound.} \\
 \hline
 \end{array}$$

Proof 95 : 11 : 3 : 15. By this you see that if 214131 Pound Weight be Divided by 28, by 4; and 20, it will produce 25 Tun, 11 C. 3 grs. 15

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15 lb. which is the Reverse of the first Question on the left hand.

Quest. 2. In 90745 Ounces how many hundred (weight?)

$$\begin{array}{r} 16 \overline{) 107} \\ \underline{114} \\ 28 \overline{) 5671} \quad 25 \\ \underline{71} \end{array}$$

4) 202 — 9 Ounces.

$$\underline{15}$$

90 : 2 : 15 : 9 Proof.

Quest. 3. In 50 : 10 : 11 how many Grains of Troy } (Silver?)
Weight }

$$\begin{array}{r} 1010 \\ \underline{24} \end{array}$$

$$\begin{array}{r} 4041 \\ \underline{2021} \end{array}$$

Ans. 24251 Grains of Silver.

Quest. 3. 507—10—11 how many Grains of S. l. } (Voz?)
Troy }
Weight }

$$\begin{array}{r} 10150 \text{ penny weight.} \\ \underline{24} \end{array}$$

$$\begin{array}{r} 40601 \\ \underline{20301} \end{array}$$

Ans. 242611 grains.

Quest. 4. In 54—2—25 Tun. hh. gall. how many Quarts of
Liquid }
Measures } 4 (Wine?)

218 hhead.

63

659

1310

13759 gallons.

4

Proof 55036 quarts.

Quest. 5. In 75—5—3—2 Last. qt. bush. gall. how many Gallons of
Dry }
Measures } 10 (Wheat?)

755 quarters.

8

6043 bushels.

Fac. 48346 gallons.

Quest. 3. In 243611 Grains how many Ounces of
24) 36 (Silver?)

121

210 101510

11

Proof 507 : 10 p. w. 11 Grains.

Quest.

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Quest. 4. In 55036 Quarts how many Tuns of
(Wine?)

$$\begin{array}{r}
 4 \overline{) 55036} \\
 \underline{69} 13739 \\
 \underline{115} \\
 4 \overline{) 218} 529 \\
 \underline{ 54} 25 \text{ Gall.} \\
 \text{Ans. } 54 : 25 \text{ Gall.}
 \end{array}$$

Quest. 5. In 48346 Gallons how many Lasts of
(Wheat?)

$$\begin{array}{r}
 8 \overline{) 6043 : 2} \\
 \underline{ 10} 75 : 3 \\
 \underline{ 75} : 3 \\
 \text{Proof } 75 : 3 : 3
 \end{array}$$

By the foregoing Examples the Learner may be sufficiently instructed in the working and proving any Sum in Reduction. I shall forbear to give you any more Examples of this Nature, my design being to improve the remaining Paper with Matter more useful, after I have given three or four more Examples in *Cloth Measure*, and *Reduction of Time*.

Cloth Measure.

Quest. 6. In 207 Ells, 2 quarters, 2 nails, how
(many Nails?)

$$\begin{array}{r}
 5 \\
 \underline{ 10} 37 \text{ quarters} \\
 \underline{ 4} \\
 \text{Ans. } 4150 \text{ Nails.}
 \end{array}$$

Quest.

Quest. 7. In 107 Yards, 3 quarters, & Nail,
(how many Nails?)

$$\begin{array}{r} 107 \text{ Yards} \\ \times 4 \\ \hline 428 \text{ quarters} \\ 4 \\ \hline \text{Ans. } 1725 \text{ Nails.} \end{array}$$

Quest. 8. In 312 Ells Flem. 2 qrs. how many
Quarters?

$$\begin{array}{r} 312 \\ \times 3 \\ \hline 938 \text{ quarters.} \end{array}$$

Quest. 9. In 112 Aulns, 1 qr. 2 Nails, how
(many Nails?)

$$\begin{array}{r} 112 \\ \times 6 \\ \hline 672 \text{ quarters.} \\ 4 \\ \hline \text{Ans. } 2694 \text{ Nails.} \end{array}$$

Long Measure.

Quest. 10. The Circumference of the Earth being
360 Degrees, and every Degree 60 English Miles,
I demand how many Miles, Furlongs, Perches,
Inches, and Barley Corns will reach round the
World?

360 Degrees.

60 Miles a Degree.

21600 Miles about the Earth.

172800 Furlongs about the Earth.

40 Perches in a Mile.

6912000 Perches about the Earth.

33 Half Feet in a Perch.

20736000

20736000

228096000 Half Feet about the Earth.

6 Inches in a half Foot.

1368576000 Inches.

3 Barly Corns in an Inch.

4105728000 Barly Corns about the Earth.

Quest.

Chap. 6. Of Reduction of Time.

95

Quest. 11. I demand how many Days, Hours, and Minutes it is, since the Birth of our Saviour Jesus Christ, on this present Year 1701.

1701 Years.

365 Days in a Year.

8305

10206

3103

620865 Days since the Birth of Christ.

24 Hours in one Day.

2483460

1701

1241730

6

1490966

10206 Hours

10206 Hours added. to be added.

14910966

Hours since the Birth of Christ.

60

Minutes in an hour.

894657960 Minutes since the Birth of Christ.

Note, That 6 Hours is lost in every Year, to Correct which, you multiply the Number of Years to be reduced by 6, and the Product will give you the Hours to be added to the given Time, as you may see in the Example above.

REDUCTION (according to the first Rule of this Chapter) Teacheth you also to Reduce the Coyns, Weights, and Measures of one Country into the Coyns, Weights, and Measures of any other Country. As for Example.

Quest. 1. I have bought 3597 Ells Flemish of Genting Cloth; I would know how many Ells English is contained therein.

The

The most Practical way to work this, is to Multiply the Ells *Flemish* by 6, and Divide by 10, which contracts the Work, because to Divide by 10, is only to cut off the last figure of the Dividend. And the Reason is this, there is 6 half quarters of a Yard in an Ell *Flemish*: And there is 10 half quarters of a Yard in an Ell *English*: The Work stands, *viz.*

3507

Ells Engl.

6

fa. 2104 $\frac{2}{3}$, which is equal to $\frac{2}{3}$ the quarter of an Ell *English*.

2104 | 2

Quest. 2. In 4215 $\frac{1}{2}$ Ells *Flemish* how many Ells *English*?

6

Ells Engl.

2529 | 3 *fa.* 2529 and $\frac{1}{2}$, or three half quarters.

Quest. 3. In 295 Ells *English* how many Portugal Veres of 15 Nails?

20

25) 5900

— 140

393 50

5

fa. 393 $\frac{1}{2}$

Quest. 4. In 205 Pistoles, at 17 $\frac{1}{2}$ how many Pound *(Ster.)*?

210

12

2050

210

410

210) 43050 Pence in all the Pistoles.

190

179 225

9

fa. 179 l. and 90 Pence.

Quest.

Chap. 6. Of Reduction.

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Quest. 5. In an Ingot of Silver, Quantity 24 lb. 7 oz.
how many Salvers, quantity 12 oz. $\frac{1}{2}$.

lb.	oz.
24	7
12	12 $\frac{1}{2}$
295	25
2	

25) 590 half Ounces.

90
23

15 fa. 23 Salvers, and 15 half Ounces.

Quest. 6. In 142 C. 3 qr. 19 lb. of Sugar, how many
(Boxes of 84 lb

4
571
28
4577
1143

84) 16007 Pound Weight.

706
190

Boxes. lb.
47 fa. 190 and 47 of Sugar.

Quest.

Quest. 7. In 35 l. 11 s. 4 d. how many Dollars at

20

(4 s. 6 d.

12

711

12

54

54) 8536

313

158 436

4 fa. 158 Dollars and 4 Pence.

Quest. 8. In 75 Hogheads of Wine how many Runlets

(of 22 Gallons?

63

225

450

22) 4725

32

214 105

Runl.

17

fa. 214 and 17 Gallons.

Quest. 9. In 905 Guinea's, at 21 s. 10 d. $\frac{1}{4}$ how many Pistols, at 17 s. 6 d.

s.

d.

s.

d.

905

21

10

 $\frac{1}{4}$

17

6

2101

12

12

905

262

210

9050

8

8

1810

2101

1680

168) 1901405

221

1131

534

300

Pistols.

132 fa. 1131 and 1325 half Farth.

Quest.

Chap. 6. Of Reduction.

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Quest. 10. Bought at Bourdeaux 10 Pieces of Pruans,
quantity 95 Quintals, I demand how many C. Weight
it makes in London?

95

Note, 100 lb. is a Quintal.

100

112) 9500

540

84

C. lb.

92 fa. 84—92 in London.

Quest. 11. A Merchant at London receives an In-
voyce from his Correspondent at Jamaica of severall
Hogsheads of Sugar, Quantity 195 C. 1 qr. 16 lb.
at Jamaica, I demand what Weight they produce
at London?

C. qr. lb.

195—1—16

4

781

25

3911

1563

112) 19541

834

174

501

C. lb.

53 fac. 174—53 in London.

12

CHAP

Quest.

CHAP. VII.

The Golden Rule, or Rule of Three Direct.

I. **T**HE Rule of Three is so called, because in it there are always *three Numbers* given to find out a *fourth*. It is also called *the Golden Rule*, for its excellent Performances in the Art of Numbers.

II. The Rule of Three is either *Single* or *Compound*.

III. The *Single* Rule of Three is either *Direct*, or *Inverse*.

IV. *The single Rule of three Direct*, is when there are *three Numbers* given to find out a *fourth* in a *direct Proportion*; That is, when the *fourth* Number ought to bear such Proportion to the *third* as the *second* doth to the *first*; Or, as the *first* is in proportion to the *second*, so is the *third* to the *fourth*. This is called a *Direct Proportion*.

V. In the *single Rule of Three*, the two first of the given Numbers imply a *Supposition*, and the third a *Demand*.

VI. The *three given Numbers* must be ranked in such order, as that the Number to which the demand is affixed may possess the *third* place, and that Number in the *Supposition*, that is of the same Name, Kind, or Quality with that in the *third* place, must possess the *first* place, and the other Number in the *Supposition* must possess the *second* place, and is evermore of the same Name, Kind, or Quality with the Number sought.

Example. If 18 Yards of Camblet cost 72 s. what will 596 Yards cost at that Rate?

In

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In this Example the Supposition is this, viz. If 18 Yards cost 72 Shillings. And in the other Number (596) is implied a Demand, viz. What will 596 Yards cost? Therefore must 596 Yards be the *third* Number, and that Number in the Supposition which is of the same kind with 596 must be the *first* Number, which here is 18, because that signifieth Yards as well as the *third* Number; and the other Number in the Supposition, which here is 72, is the *second* Number, and is of the same kind with the *fourth* Number, or Number sought; for the Number sought by the Question is the Price of 596 Yards, and the *second* Number is the Price of the *first*, viz. 72 Shillings. Now the given Number being duly stated and ranked according to the foregoing Directions will stand thus,

yds.	s.	yds.
18 —————	72 —————	596

VII. In the Single Rule of Three Direct, if you Multiply the *second* Number by the *third*, or (which is all one) the *third* Number by the *second*, and divide the Product thereof by the *first*, the Quotient thence arising is the *fourth* Proportional Number sought, or Answer to the Question. As in the foregoing Example, viz. If 18 Yards of Camblet cost 72 Shillings, what will 596 Yards cost at that rate? The Numbers given in the Question being ranked according to the Directions given in the sixth Rule, I multiply the *second* Number (72) by (596) the *third* Number, and the Product is 42912 which being divided by (18) the *first* Number, the Quotient is 2384, which is the *fourth* Number, or Answer to the Question. See the whole Operation as followeth, viz.

^{yds} 18 give — ^{s.} 72 — what will ^{yds.} 396
 72

 1192

 4172

 18) 42912 shil.

 69

fa. 2384 151

shil. 72

 0

VIII. When (according to the foregoing Directions) you have found out the Answer to the Question, you are always to esteem it of the same Name that your second Number was of, or reduced to. So here in the foregoing Example, the Answer to the Question is 2384 Shillings, because the second Number is 72 Shillings. And if the second Number had been reduced into Pence, it makes 864, and then the Answer would have been 28608 Pence, as by the following Operation appears.

<i>yards.</i>	<i>s.</i>	<i>yards.</i>
18 give	72	what will 596
	12	864
	864	2384
		3576
		4768
		18) 514944
		154
		fa. 28608 109
		144
		0

fa. 28608 pence, equal to 2384 shillings.

red
tion,
that
here
Que-
ber is
en re-
swer
w ing

Likewise if the *second* Number had been reduced into *Farthings*, it would have been 3456, which being multiplied by (596) the *third* Number, the Product is 2059776, which being divided by (18) the *first* Number, the Quotient is 114432 *Farthings*, equal to 1191. 4 *s.* as before; which you may prove at your leisure.

IX. When the *second* Number consisteth of divers Denominations, as, of *Pounds* and *Shillings*, or of *Pounds*, *Shillings*, and *Pence*, then you must reduce it to the lowest name mentioned, or lower if you please, and then multiply the *second* by the *third*, and divide the Product by the *first*, &c. as before directed.

Example II.

If 26 Yards of Broad Cloth cost 12 l. 02 s. 08 d.
what will 248 Yards of the same cost at that Rate?

The given Numbers in the Example being ranked according to the Directions given in the Sixth Rule foregoing will stand thus,

yds.		l.	s.	d.		yds.
26	_____	12	—	02	—	08
						— 248

Here the *second* Number consisteth of divers Denominations, *viz.* Pounds, Shillings, and Pence. Therefore must it be reduced to the lowest Name mentioned, which is Pence, and it makes 2912, which being Multiplied by (248) the *third* Number, the Product is 722176, which being divided by (26) the *first* Number, the Quotient is 27776 Pence, because the *second* Number was reduced into Pence, which is the Answer to the Question, and may be reduced to 113 l. 14 s. 08 d. As you may see by the following Operation.

242 shillings.
12

2912
248

23296
11648
5824

26) 722176
— 202

12) 27776 d. 201

$$\begin{array}{r} \text{---} \quad 197 \\ 2 \overline{) 2314} : 8 \quad 156 \\ \text{---} \quad \text{---} \\ 115 : 14 : 8 \quad 0 \end{array}$$

s. d.
fr. 115- : 14 : 8.

X. If the *first* and *third* Numbers, or either of them, consist of divers Denominations, then must they be both reduced to the lowest Denomination mentioned in either of them, as if the *first* Number be Hundred Weights only, and the *third* be Hundreds, Quarters, and Pounds, then must they be both reduced into Pounds, because Pounds are mentioned in the *third* Number. Or if the *first* and *third* Numbers being of one kind, are notwithstanding of different Denominations,

nations, then must they be reduced to one Denomination; as if the *first* be Pounds of Weight, and the *third* be Hundred Weights, then must the *third* Number be reduced to Pounds as is the *first*.

Example III.

If 1 C. Weight of Tobacco cost 4 l. 5 s. 2 d. what will 34 C. 3 qrs. 18 lb. cost at that rate?

In this Example, because the *third* Number has Pounds mentioned therein, therefore must the *first* and *third* Numbers be both reduced to Pounds, and the *second* Number, which is 4 l. 05 s. 02 d. must be reduced into Pence by the fifth Rule of Chap. V. and then the *second* Number being multiplied by the *third*, the Product is 3996020, which being divided by the *first*, the Quotient is 35678 Pence, which is equal to 148 l. 13 s. 02 d. and 84 remaineth, and how that or any other such like remainder may be ordered, shall be taught by and by See the following Operation.

lb.	l.	s.	d.	C.	qr.	lb.
112 cost	4	5	2	34	3	18
	20			4		

83

139

12

28

1022 pence

1120

279

3910

1022

7820

7820

39100

112) 3996020

636

12) 35678 760

882

297|3:2d. 980 84

Facit 148 : 13 : 2 ²⁴/₁₁₃ 84 42

Example

If 14 lb. of Sugar cost 5 s. 3 d. what will 46 C. Weight cost at that rate ?

In this Example the third Number must be reduced into Pounds, because the first Number is Pounds, and it makes 5152, and the second Number must be reduced into Pence, making 63 then the

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the second number being multiplied by the third, the Product is 324576, which being divided by (14) the first Number, the Quotient is 23184 Pence for the Answer; which is equal to 96 l. 12 s. as by the following Operation appears.

lb.	s.	d.	C.
14	Sugar 5	3	46
	12		112
	63		92
			506
			5132
			63
			15456
			30912
		14) 324576	
		12) 23184	44
			25
		193 2	117
			56
			0

facit 96. 12 s.

Ex. XI. When you have multiplied the second Number by the third, and divided the Product thereof by the first. If any thing remain after Division is ended, it is part of an Unit in the Quotient, and its value may be found out thus, *viz.*

Multiply the said Remainder by the parts of the next inferior Denomination that are equal to an Unit of the Quotient; and divide that Product by the first Number, so shall the Quotient be the

Cha
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and
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the
thus
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you
ced
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In
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it is
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the value of the said remainder in the said parts, and if any thing yet remain, multiply it by the parts of the next inferior Denomination, that are equal to an Unit of the last Quotient, and divide the Product by the said Number, &c. Proceed thus till you have brought it as low as you desire. And if any thing remain at last of all, it is a part of an Unit of the least Denomination into which you reduce the said Remainder, and must be placed according to the Direction given in the fourth Rule of the fifth Chapter.

In the third Example foregoing after the Division is ended, there is a remainder of 84, which sheweth that the Answer to the Question is not exactly 35678 Pence, or 148 *l.* 13 *s.* 02 *d.* as it is there found, but it is something more; therefore to find the value of this Remainder 84, I multiply it by 4, (because 35678 the said Quotient is Pence) and the Product is 336, which I divide by the first Number 112, and the Quotient is 3 Farthings, without any other Remainder, and so is the true Answer to that question 148 *l.* 13 *s.* 02 *d.* $\frac{3}{4}$. Mind the Operation of the next Example.

Example

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Example V.

If 1 C. Weight of Currans cost a l. 14 s. what will
24 C. 3 qrs. 16 lb. cost at that rate?

lb.	l.	s.	C.	qr.	lb.
112	—	2	—	14	
	20				
	54				

lb.	qr.	lb.
24	—	3
	16	

20

4

99

28

798

199

2788

54

11152

13940

112)

150552

385

495

472

24

12

288

64

4

256

32

{ bill. 1344
 { pence 2
 { farth. 2

In the Work of the foregoing Example, you
may observe that the second Number is reduced
no

Chap. 7. Rule of Three Direct.

111

no lower than Shillings, making 54; therefore the Quotient is 1344 Shillings, equal to 67 l. 4 s. and there is a Remainder of 24: Therefore to find out how many Pence is contained therein, I multiply it by 12, and the Product is 288, which being divided by 112 (because that is the first Number) the Quotient is 2 Pence, and there is a Remainder of 64, which I multiply by 4, (to find its Value in Farthings,) and the Product is 256, which I divide again by 112, and the Quotient is 2 Farthings, and there is a Remainder of 32, which according to the 4th. Rule of Chapter VI. is $\frac{1}{2}$ of a Farthing; and so the Answer to the Question is 67 l. 04 s. 2 d. 2 qrs. $\frac{1}{2}$ The like may be observed of any other.

Example VI.

If 24 Yards of Cambles cost 4 l. 16 s. I demand how many Yards I may buy for 126 l. Facts 360 yds. The Terms being ranked as is directed in the Sixth Rule of this Chapter, will stand thus, viz.

l.	s.	yds.	l.
4	16	24	126
20			20
96			3520
			24
			10080
			5040
			96) 60480
			288
			630
			00

Having

Having thus demonstrated the reason of the *Single Rule of Three Direct* in the six foregoing Examples, I shall proceed now to propose several Questions in the Rule of Three for the Learners Practice, and only set down their *Facits*, as a further help to them in the working of their Questions.

Question 1. If an Ounce of Silver cost 3 s. 4 d. what will 46 oz. 15 pw. 12 gr. cost? *Facit* 12 l. 09 s. 3 d. $\frac{3}{4}\frac{3}{4}\frac{3}{4}$.

Quest. 2. If 12 Yards of Broad-cloth cost 7 l. 6 s. I demand how much I ought to give for 26 Pieces, each Piece containing 27 Yards? *Facit* 427 l. 1 s.

Quest. 3. If 18 yards of Cambrick cost 4 l. 13 s. I demand the Price of 73 Pieces, each Piece containing 34 Ells *Flemish*? The Ell *Flemish* being 3 quarters of a yard? *Facit* 480 l. 17 s. 9 d.

Quest. 4. If 17 C. 3 qrs. 17 lb. of Tobacco cost 145 l. 12 s. I demand how much the Ounce stands me in at that rate? *Facit* 1 d. $\frac{3}{4}\frac{5}{8}\frac{6}{8}\frac{4}{8}$ per Ounce.

Quest. 5. If 112 lb. of Lead cost 15 s. 11 d. I demand the Price of 54 Fother, each being 19 C. $\frac{1}{2}$? *Facit* 838 l. 0 s. 3 d.

Quest. 6. When 7 lb. of Tobacco cost 5 s. 9 d. $\frac{1}{2}$ what will 30 C. weight cost? *Facit* 139 l.

Quest. 7. When the Tun of Wine cost 51 l. 14 s. what cost the Quart at that rate? *Facit* 12 d. $\frac{1}{2}$.

Quest. 8. At a Noble per Week, how many Months Board may I demand for 50 l? *Facit* 22 Months and 2 Weeks.

Quest. 9. A Grocer bought 30 Fraills of Raisins, each Frail weighing 91 lb. weight, at 18 s. 8 d. per C. I demand how much they amount to? *Facit* 22 l. 15 s.

Quest

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Quest. 10. What comes the Commission of 642 l. 11 s. 09 d. to at 3 $\frac{1}{2}$ per Cent. *facit* 22 l. 9 s. 9 d.

Quest. 11. What comes the Insurance of 375 l. 9 s. 4 d. to at 3 Guinea's per Cent. the Guinea's at 21 s. 9 d. $\frac{1}{2}$? *facit* 12 l. 5 s. 6 d.

Quest. 12. A Corn Factor bought 248 Quarters of Wheat for 511 l. 06 s. 8 d. for an 100 Quarters of which he gave 33 s. 04 d. per Quarter, I demand how much he gave per Quarter for the Remainder? *facit* 2 l. 6 s. 6 d.

Quest. 13. If a Piece of Cloth cost 21 l. 5 s. I demand how many Yards were in the same, the Yard being valued at 12 s. 6 d? *facit* 34 Yards.

Quest. 14. If a Piece of Cloth cost 24 l. 5 s. 4 d. I demand how many Yards were contained in the same, when the Ell English is worth 17 s. 4 d.? *facit* 35 Yards.

Quest. 15. Bought 124 Pieces of Camblet for the Sum of 987 l. 14 s. 8 d. at 4 s. 8 d. per Yard, I demand how many Yards there were in all, and how many Ells *Flemish* there were in a Piece? *facit* 4233 Yards, and 45 $\frac{1}{2}$ Ells *Flemish* per Piece.

Quest. 16. A Gentleman, hath an Estate of 1224 l. per Annum, and his Expences one day with another amount to 1 l. 13 s. 4 d. I demand how much he layeth up at the Years end to purchase with? *facit* 615 l. 13 s. 4 d.

Quest. 17. A Gentleman expendeth one day with another 43 s. 6 d. $\frac{1}{2}$ and at the Years end layeth up 850 l. I demand his Annual Estate? *Facit* 1644 l. 12 s. 8 d. $\frac{1}{2}$ per Annum.

Quest. 18. Bought 3 Hogsheads of Nutmegs, bf. viz. at 5 s. 7 d. the Ounce, I demand the Neat cost thereof?

	C.	qr.	lb.
N ^o 1	3	2	21
2	4	1	14
3	4	2	18
	12	2	25
	4		
	50		
	28		
	405		
	102		
	1425		
	16		
	8550		
	1435		

22800 at 5 s. 7 d. Fa. 6365 l.

Quest. 19. A Merchant consigns to his Factor in Spain 188 Cloths, with Commission for Sale at 23 l. 2 s. 2 d. per Cloth, and to make Returns from thence, the one half in Wines at 28 l. per Tun, and the other half in Sugar at 27 s. per C-Weight, I demand how much of each ought to be returned for the Cloths?

Answer, The whole Value of the Cloth is 4344 l. 7 s. 4 d. the half whereof is 2172 l. 2 s. 8 d. which will buy $77 \frac{1384}{112}$ Tuns of Wine at 28 l. per Tun, and the other half will buy 1609 $\frac{8}{112}$ Hundred Weight of Sugar.

Quest.

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Quest. 20. If 100 *l.* in 12 Months gain 6 *l.* Interest, what will be the Interest of 896 *l.* for the same time, *facit* 53 *l.* 15 *s.* 2 *d.* $\frac{4}{5}$.

Quest. 21. An Usurer putteth out 880 *l.* to Interest, and at the end of 12 Months he receives for Principal and Interest 932 *l.* 16 *s.* I demand at what rate *per Cent. per Annum* he received Interest? *facit* 6 *per Cent.*

Quest. 22. I demand what Principal in 12 Months will gain 64 *l.* 10 *s.* at the Rate of 6 *per Cent.* *facit* 1075 *l.*

Quest. 23. An Orphan is indebted to his Guardian 51 *l.* and the Guardian having in his hands 100 *l.* of the Orphan's, it is agreed between them, that the Guardian shall keep the same in his Hands till the said 51 *l.* be paid by the Interest thereof at 6 *per Cent. per Annum.* Now I demand how long he ought to keep the same at that Rate? *facit* 8 Years and 6 Months.

Gain and Loss.

Quest. 24. A Draper buys 2795 $\frac{1}{2}$ Ell *Flem.* of Ghenting, at 22 *d.* $\frac{1}{2}$ the Ell *English.* It is required to know at what Price the Cloth must be sold out to gain 15 *l.* 10 *s.* *per Cent.* First find the Price it cost by the Rule of Three, *facit* 157 *l.* 4 *s.* 11 *d.* Then say, if a 100 *l.* give 15 *l.* 10 *s.* what will 157 *l.* 4 *s.* 11 *d.* *facit* 24 : 7 : 5. which added to 157 : 4 : 11 makes 181 : 12 : 4. Or if 100 *lb.* give 115 : 0 : what will 157 : 4 : 11 *Fa.* 181 : 12 : 4. which is answered at one Operation.

Loss and Gain.

Quest. 25. If the aforesaid Cloth were to be sold so as to lose 15 *l.* 10 *s.* *per Cent.* First subtract

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tract 15*l.* 10*s.* out of 100*l.* *facit* 84*l.* 10*s.*
Then say, If 100*l.* fall to 84*l.* 10*s.* what shall
157*l.* 4*s.* 11*d.* *facit* 132*l.* 17*s.* 6*d.*

Fellowship.

Quest. 26. Three Merchants Company ; *A* his
Stock was 175*l.* 12*s.* *B*'s 214*l.* 19*s.* 4*d.* *C*'s
150*l.* 11*s.* 9*d.* they have gained together 209*l.*
11*s.* 4*d.* I demand each Man's part of the said
Gain? First add the several Stocks into one Total,
which makes 541*l.* 3*s.* 1*d.* then make three several
Questions in the Rule of Three, viz.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 541	: 3	: 1	give 209	: 11	: 4	what 175	: 12	: 8 <i>A</i>
If 541	: 3	: 1	give 201	: 11	: 4	what 214	: 19	: 4 <i>B</i>
If 541	: 3	: 1	give 209	: 11	: 4	what 150	: 11	: 9 <i>C</i>

facit

Add all the *facits* together, if it make up the
Money to be divided, your *Sum* is true. If you
have any remains on the Divisions add them up
into one Total, which divide by the common
Divisor, and the Quotient add to the lowest De-
nomination.

Fellowship with Time.

Quest. 27. Three Merchants Company. *A* his
Stock was 109*l.* 5*s.* for 3 Months. *B* 450*l.*
7*s.* for 4 Months. *C* 147*l.* 12*s.* for 6 Months,
they have gained 209*l.* 7*s.* 2*d.* I demand each
Man's part.

This

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This is worked as the last precedent Question, only each Man's Stock is multiplied by the time, viz.

A 109—05	B 450—7	C 147—12
3 mo.	4 mo.	6 mo.

A 327—15	B 1801—8	C 885—12
B 1801—08		
C 885—12		

— — — — — l. s. d.	l. s.
--------------------	-------

If 3014 : 15 : gain : 209 : 7 : what will 327 : 15 A

If 3014 : 15 gain 209 : 7 : 2 what will 1801 : 08 B

If 3014 : 15 gain 209 : 7 : 2 what will 885 : 12 C

—
facit.
—

Add all the *facits* together, if it make the given Sum 209 l. 7 s. 2 d. your Work is true, otherwise false.

The Proof of the Single Rule of Three Direct.

To prove a Question in the *Single Rule of Three Direct*, Multiply the fourth Number (or Answer to the Question) by the *first*, and if the Product thereof be equal to the Product of the *second* and *third*, then is the Operation truly performed, otherwise not ; as in the first Example of this Chapter, viz.

If 18 Yards cost 72 Shillings, what will 596 Yards cost at that rate ? The Answer there found is 28608 Pence, which is the fourth Number. Now the Product of the first and fourth, viz. 28608 by 18 is 514944, which is equal to the Product

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Product the second and third, viz. 864 by 596 as you may see by the following Operation, where the second Number, viz. 72 Shillings is reduced into 864 Pence.

<i>yrds.</i>	<i>d.</i>	<i>yrds.</i>	<i>d.</i>
18	864	596	28608
	596		18
	5184		228864
	7776		28608
	4320		
	514944		514944

And here note, That if any thing remain after Division is ended, it must be added to the Product of the *first* and *fourth* Numbers, and then must that Sum be equal to the Product of the *second* and *third*. As in the third Example of this Chapter, which is, If 1 C. Weight of Tobacco cost 4 l. 5 s. 2 d. what will 34 C. 3 qrs. 18 lb. cost?

The 3 given Numbers being reduced, are 112 l. 1022 d. and 3910 l. and the fourth Number or Answer to the Question is there found to be 35678 d. and the Remainder is 84, the Product of the second and third is 3996020, and the Product of the first and fourth is 3995936, to which adding the remainder, the Sum is 3996020, equal to the Product of the *second* and *third*, which proves the Work to be true.

l.	d.	l.	d.
112	1022	3910	35678
		1022	112
		7820	71356
		7820	35678
		39100	35678
		3996020	3995936
		remains	add 24
			3996020

C H A P. VIII.

The Single Rule of Three Inverse.

I. **T**H E *Single Rule of Three Inverse*, is when the fourth Number, or Number sought, ought to bear such proportion to the first, as the second doth to the third.

II. When a Question in the *Single Rule of Three* is stated, consider whether the fourth Number (or Answer to the Question) ought to be more or less than the second Number, which upon a little Consideration you may discover. If it ought to be more than the second, then must the lesser extremum be the Divisor, and if it ought to be less than the second, then must the biggest of the extremes be the Divisor, (in this Case the first and third Numbers are called extremes) and if it fall out that the third Number is the Divisor, that Question is said to be of *The Single Rule*.

Rule of Three Inverse. As in the following Examples.

Example 1.

If 30 Men can build a Wall in 32 Days, I demand in how many days 60 Men may do the same?

The given Numbers being ranked according to the sixth Rule of the seventh Chapter, will stand as followeth.

<i>Men</i>	<i>Days</i>	<i>Men</i>
30	32	60

Then I consider whether 60 Men will do it in more or less days than 32, and find that they will require less time than 32 days, (for the more the Men the lesser the time) wherefore 60, which is the biggest extream, must be the Divisor, and the first and third must be multiplied together, and their Product, which is 960, being divided by the third Number 60, the Quotient is 16 days, and in so long time will 60 Men finish the said Work. See the following Operation.

<i>Men</i>	<i>Days</i>	<i>Men</i>
30	32	60
	30	

60) 960

16 Days

Example

Example II.

If 100 l. in 12 Months gain 10 l. for the Interest thereof, I demand what Principal will gain the same Interest in 8 Months?

Here it being required what Principle will gain 10 l. in 8 Months, therefore must 100 l. Principal be the second Number, according to the Directions in the Sixth Rule in the seventh Chapter, and the Numbers being ranked accordingly, will stand thus?

<i>Mon.</i>		<i>l.</i>		<i>Mon.</i>
12	-----	100	-----	8 ?

Here I consider, that the shorter the time, the more must be the Principal to gain the same Interest; wherefore the lesser extream must be the Divisor, which here is (8) the third Number, therefore the first and second, viz. 12 and 100 must be multiplied the one by the other, and the Product is 1200, which being divided by (8) the third Number, the Quotient is 150 l. and so much will gain 10 l. Interest in 8 Months at 10 per Cent. per Annum: See the following Work.

12	-----	100	-----	8
		12		

		8) 1200		

		facit 150		

F

Example

Example III.

Lent my Friend 120 l. for 6 Months, he promising to do me the like Courtesie another time; and not long after I had occasion for a Sum of Money for 9 Months, I demand how much he ought to lend me for that time to retaliate my former Kindness?

Facit 80 l. The longer the time, the lesser ought the Sum of Money to be.

Example IV.

A Footman performs a Journey in 12 days, when the day is 15 hours long, I demand in how many days he may perform the same when the day is 10 hours long?

Facit 18 days. The shorter the days, the more days will the Journey require.

Example V.

How many Yards of Matting that is half Yard wide, is enough to cover a Floor that is 16 Foot wide, and 28 Foot long?

Facit 298 $\frac{2}{3}$ Yards of Matting.

Example VI.

Suppose that (according to the Statute) when the Bushel of Wheat cost 4 s. the Penny-Loaf ought to weigh Nine Ounces, I demand what the Price of the Bushel ought to be, when the Penny-Loaf weigheth 12 Ounces?

Facit 3 s. per Bushel.

Example

Example VII.

If when the Tun of Wine cost 45 l. a certain quantity worth 25 s. is sufficient for the Accommodation of 20 Men, I demand how many Men the same 25 s. worth will suffice when the Tun is worth 30 l.

Facit 30 Men, for the cheaper the Wine, the more may be bought for the same Money.

Example VIII.

If when the Tun of Wine cost 45 l. a quantity worth 50 s. is enough for the Entertainment of 40 Men, I demand the Price of the Tun when 50 s. worth is enough for 90 Men? Facit 20 l. per Tun.

Example IX.

If 60 Ells at London be equal to 100 Ells at Antwerp, and each Ell at London remains 20 Nails of an English Yard, I demand how many such Nails the Ell of Antwerp contains? Facit 12.

Example X.

If for 5 l. 3 s. 4 d. I can have 10 C. weight carried 140 Miles, I demand how many Miles I may have 14 C. weight carried for the same Money?

Facit 100 Miles.

The Proof of the Single Rule of Three Inverse:

If the Product of the fourth Term multiplied by the Third, be equal to the Product of the Second multiplied by the First, then is the Work truly performed, otherwise not.

F 2

Let

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Let us prove the first Example of this Chapter, viz. If 30 Men can build a wall in 32 days, I demand in how many Days 60 Men may do the same? The Answer is there found to be 16 days, and the four Terms being duly ranked, stand as followeth.

<i>Men</i>	<i>days</i>	<i>Men</i>	<i>days</i>
30	32	60	16
30			60
960			960

The fourth Term (16) being multiplied by (60) the third Term, is 960, which is equal to the Product of (32) the second Term, by (30) the first.

C H A P. IX.

The Double Rule of Three Direct.

I. **T**H E Double Rule of Three, is when there are Five Numbers given to find out a Sixth in proportion thereunto.

II. A Question in the Double Rule of Three may be resolved by Two Single Rules of Three, or by One Rule of Three composed of the five given Numbers.

III. When a Question in the Double Rule of Three may be solved by Two Single Rules of Three Direct, that Question is said to belong to the Double Rule of Three Direct.

IV. Of

IV. Of the five Numbers given in the *Double Rule of Three*, three of them always imply a Supposition, and the other Two a Demand. As in the following Example.

If 16 Men can reap 96 Acres of Wheat in 36 days, I demand how many Acres 64 Men may reap in 48 days?

Here the Supposition is, If, or Suppose, 16 Men reap 96 Acres in 36 days; and the Demand is, How many Acres 64 Men may reap in 48 days?

V. When you would solve a Question in the *Double Rule of Three*, the given Numbers are to be so ranked, that the First and Third may be of one Denomination, and the Second Number must be of the same Quality, Name, or Denomination with the Number sought; and note, That the First and Second Numbers must be always of the Supposition, and the Third of the Demand. So likewise must the Fourth Number be of the Supposition, and the Fifth of the Demand, and both of one Denomination; so may each Question be solved by Two single Rules of Three, two different ways. As in the Question foregoing, which being again repeated is as followeth.

If 16 Men can reap 96 Acres of Wheat in 36 days, How many Acres may 64 Men reap in 48 days? The Numbers being ranked according to the foregoing Directions, which stand as followeth.

	Men	Acres	Men
	16	96	64
days	36		48 days
		Or thus,	
	Days	Acres	Men
	36	96	48
Men	16		64 Men

VI. When a Question in the Double Rule, of Three is to be solved at two several Operations in the Single Rule of Three, the Answer to the first Question must be the second Number in the second Question, and the fourth and fifth Numbers must be the first and third in the second Question.

So in the first order of ranking the given Numbers in the foregoing Question, the three first Numbers, are 16—96—64, wherein is implied this Question, viz. *If 16 Men can reap 96 Acres, How much may 64 reap in the same time, viz. in 36 Days?* Multiply and divide according to the Directions given in the Seventh Rule of the Seventh Chapter, and you will find the Answer to be 384 Acres; so that now I have found how many Acres 64 Men may reap in 36 days, but by the Question it is required to know how much they can reap in 48 days.

Therefore I say again by the Single Rule of Three, *If 36 days will reap 384 Acres, How many may be done in 48 days?* Multiply and Divide, and you will find the Answer to the Question to be 512 Acres, and so many may 64 Men reap in 48 days, if 16 Men can reap 96 Acres in 36 days. See the whole Work as followeth.

Men

Days	Acres	Days
36	96	48
Men 16		64
36	96	48
	96	128
	288	512
	432	768
	4608	8192
	100	19
facit 128 Acr. 288		facit 512 Acr. 32
	01	0

I doubt not, but that by the Operation before going, this Rule is sufficiently illustrated; but for the Learners further Experience herein, I shall propound several other Examples, and only give their Answers, leaving the Operations to the Industrious Learner.

Example 2. I demand the Interest of 75 l. for 18 Months, after the rate of 6 per Cent. per Annum.

This Question may be more intelligibly stated thus, viz. If 100 l. in 12 Months gain 6 l. Interest, What will 75 l. gain in 18 Months at that rate? facit 6 l. 15 s.

Example 3. If 12 Men can reap 48 Acres of Wheat in 18 days, I demand how many Acres 36 Men may reap in 24 days? facit 192 Acres.

Example 4. If 3 Quarters of Malt is sufficient for a Family of Six Persons for two Months, How many Quarters is enough for a Family of 18 Persons for 12 Months? facit 34 Quarters.

Example

Example 5. If 8 Reapers have 3 l. 4 s. for 4 days Work, I demand how much 24 Men will have for 16 days Work? *facit* 38 l. 8 s.

Example 6. If 336 lb. of Bread is sufficient for 36 Men for 12 days, I demand how much will serve 460 Men 96 days? *facit* 22080 lb. of Bread.

Example 7. If 40 Bushels of Oats be enough for 8 Horses 20 Days, I demand how many Bushels will serve 48 Horses 12 days? *facit* 144 Bushels.

Example 8. A Banker took in 250 l. to pay Interest for the same, and at the end of 18 Months he paid 272 l. 2 s. for Principal and Interest, I demand at what Rate per Cent. per Annum, he paid Interest?

CHAP. X.

The Double Rule of Three Inverse.

I. **W**HEN a Question in the Double Rule of Three being solved at two Single Rules, as is taught in the foregoing Chapter, hath one of those Single Rules Inverse, (for they are never both Inverse) then is that Question said to be of the Double Rule of Three Inverse.

II. A Question in the Double Rule of Three Inverse, may be stated two several ways, as well as a Question in the Double Rule Direct, and so the Inverted Proportion may be either in the first or second Operation at pleasure.

Example. 1. If a Footman Travel 240 Miles in 8 days, when the day is 10 hours long, I demand in how many days he may Travel 720 Miles, when the day is 15 hours long? F 5 The

The given Numbers being ranked according to the fifth Rule of the ninth Chapter, will stand as followeth :

<i>Miles</i>		<i>Days</i>		<i>Miles</i>
240	—	8	—	720
<i>Hours</i> 10	—		—	15 <i>Hours</i>

Or thus,

<i>Hours</i>		<i>Days</i>		<i>Hours</i>
10	—	8	—	15
<i>Miles</i> 240	—		—	720 <i>Miles</i>

Here according to the first manner of ranking the given Terms, the Inverted Proportion is in the second single Operation.

III. You may also work the Double Rule of Three either *Direct* or *Inverse* at one Operation, by the *Compound Rule of five Numbers*, observing to rank the several Terms as is before taught in the fifth Rule of the Ninth Chapter.

IV. And if your Question be of the Double Rule of three *Direct*, Multiply the three last Terms together for Dividend, and the two first for Divisor, as in the following Examples, *viz.*

If 100 l. in 12 Months require 6 l. Interest, How much Interest will 50 l. require in 10 Months?

l. mo. l.
 100 ——— 12 ——— 6
 10 ——— 10

l.
 50
 10 m.

100
 12

500
 6

facit 2 l. 10 s. 12|00

30|00

2|10

V. But if your Question be of the Rule of Three Inverse, Multiply the first, second, and last Numbers together for Dividend, and the third and fourth for Divisor, as in the following Example.

Example. If 50 l. in 10 Months require 2 l. 10 s. Interest, Of what Principal shall the Interest of 6 l. make in 12 Months?

l. mo. l. s.
 If 50 ——— 10 ——— 2 ——— 10
 12 ——— 6

facit 100 l.

l. s.
 2 ——— 10
 12

50
 10

500
 6

30|00

300|0

facit 100—

This last being a Question in the Rule of Three Inverse, according to the Directions given in the Fifth Rule of this Chapter, I multiply the first, second,

second, and last Numbers together for Dividend, which produces 3000. Then I multiply 2 l. 10 s. my third Number by 12, my fourth Number, and say, 12 times 10 s. is 120, I put down a (0) and carry 6 l. to the place of Pounds, and say, 12 times 2 is 24, and 6 l. carried is 30 for my Divisor. Then I divide and the Quotient is 100 l. being the Principal that 6 l. Interest will make in 12 Months, which was to be proved.

But a more particular Application shall be made of the Double Rule of Three, when we come to treat of Simple Interest.

C H A P. XI.

Of Exchange.

HAVING Explained the Nature of the Rule of Three, and the manner of Resolving Questions therein, I am naturally led to treat of its particular Use in the **E X C H A N G E** of Coyns.

In the **Exchange** of Coyns, it is necessary that the *Par* or *Value* of the *Money* in each place be exactly known. For the Word *Par* signifies to Equalize the *Money* of *Exchange* from one *Place* with that of another *Place*. As when I take up so much *Money* per *Exchange* in one *Place*, to pay the just *value* thereof in another kind of *Money* in another *Place*, without having Respect to the price Currant of *Exchange* for the same, but only to what the *Money* does currantly pass for in each place. From whence may be easily found out the *Profit* and *Loss* of all *Monys* Drawn, or
Re-

Remitted by Exchange. But this *Par* being grounded principally upon the *Current Value* of Coyn, the Plenty and Searcity thereof, the Rising and Falling, Inhanfment and Debasing of the same, it must necessarily follow, that the Value of Coyn is Subject unto Change. An Example whereof you have in *France*, where their Coyn has been Changed, Inhanfed and Lowred for several times in a few Years; and in this present year 1702. the French Crown which was 60 *Sous* or 3 *Livers*, is now raised to 75 *Sous* or 3 *Livers* 15 *Souls*.

The Denominations in which *England*, and the following Places Exchange each with other are *Viz.*

The Exchange of Monies from *London* to *Antwerp*, *Amsterdam*, *Hambrough*, *Lisse*, *Midleborough* and other parts of *Flanders* and *Holland*, is Valued on the *Pound Sterling* of 20 *Shillings*. That is to pay after the rate of so many *Shillings*, and *Pence Flemish* for every *Pound Sterling*.

The Exchange from *London* to *Paris*, *Roan*, and most parts of *France* is Valued on the *French Crown* at 54 *d.* that is to pay so many *Pence*, or so many *Shillings* and *Pence Sterling*, for the *French Crown*.

The Exchange from *London* to *Venice* is made on the *Ducats* at 52 *d.* *Sterling*, to pay so many *Pence* and parts of a *Penny Sterling* for every *Ducat*.

The Exchange from *London* to *Leghorn*, *Genoa*, *Cales*, *Madrid*, and other parts of *Spain*, is made on the *Dollar* or *Piece of Eight*, at 54 *Pence Sterling*, that is to pay so many *Pence* on parts of a *Penny Sterling* for every *Dollar*.

The

The P A R at Antwerp, Amsterdam, Hambrough, Lisse, Middleborough and other Parts of Flanders with our Pound Sterling, is thirty three Shillings 4 Pence Flem. for a Pound Sterling, which 33 Shillings 4 d. do make 10 Guilders at 2 Shillings Sterling the Guilder, or 10 Livers Tournois.

The P A R at Paris, Roan, and other Parts of France, has been reckoned some times at 71 Sous the Crown of 3 Livers Tournoys, generally at 60 Sous the Crown of 3 Livers. Every Liver valued at 1 Shilling 6 Pence Sterling, the Crown valued at 4 s. 6 d. Sterling.

The P A R at Leghorn, Madrid, Cales, Genoa, is at 54 Pence Sterling for the Dollar or Piece of Eight.

The P A R at Venice with our Sterling Money is at 6 Livers 4 Sous of Venice per Ducat, or 51 pence Sterling, sometimes 52 Pence.

The Hambrough P A R is sometimes reckoned at Four Ricks Dollars and a half, which makes 32 Shilling Flemish for 20 Shillings Sterling.

The P A R at Lisbon is at 6 s 8 d. $\frac{1}{2}$ Sterling on the Milrea or 1000 Reas.

The P A R at Oporto is the same as that at Lisbon.

Chap. 11, Value of Foreign Coyn, &c. 135

The Value of the most usual Coyns with which England does chiefly Exchange are, viz.

Sterling money

	s.	d.
<i>Holland & Flanders.</i> { 1 Stiver is —————	0	1 $\frac{1}{2}$
6 Stiver of 1 Shilling Flemish is ———	0	7 $\frac{1}{2}$
20 Stivers is 1 Guilder or ———	2	0
6 Guilders a Pound Flem. of 20 s. is ———	12	0
33 Shill. 4 d. Flemish is ———	20	0
1 Zeland common Dollar is ———	3	0
1 Duccatoon ———	6	0
1 Specie Dollar ———	5	0

	s.	d.	q.
<i>France.</i> { 12 Deners or 1 Soult is ———	0	0	$\frac{3}{4}$
20 Soult or 1 Liver is ———	1	6	
3 Livers or 1 French Crown ———	4	6	

Sterling money

	s.	d.
<i>Spain.</i> { a Mervid is about $\frac{1}{4}$ and $\frac{1}{4}$ of 1 d. ———	0	0 $\frac{5}{7}$
34 Mervides is a Rial or about ———	0	4 $\frac{3}{4}$
11 Rials plate is 1 Duccat or ———	4	4 $\frac{1}{4}$
10 Rials plate 1 piece of Eight or ———	4	0
1 Rial Copper (is called) Velloon or ———	0	3 $\frac{1}{2}$
15 Rials Copper 1 Ps. of eight is about ———	4	0

& Note the Rial was formerly valued at 6 pence Sterling or very near it, and then 8 Rials was 1 Piece of $\frac{8}{3}$, but the Money is of late years altered.

Sterling money

	s.	d.
<i>Portugal.</i> { 12 $\frac{1}{2}$ Reas of Portugal ———	0	1
1 Mil Rea or 1000 Reas ———	6	8
1 Festoon is ———	1	3

1 Liver

Sterling money

Italy,	1 Liver at Leghorn is	—	—	—	0 : 9
	1 Crown Currant at Florence is	—	—	—	5 : 3
	1 Ducat de Banco at Venice is	—	—	—	4 : 4
	1 St. Mark	—	—	—	2 : 10
	1 Palarmo Florin is	—	—	—	2 : 6

Germany.	1 Rix Dollar of the Empire	—	—	—	4 : 5 $\frac{1}{4}$
	4 $\frac{1}{2}$ Rix Dollars makes 32 stem.	—	—	—	—
	at Hambrough, &c.	—	—	—	20 : 0
	1 Guilder of Noremburg is	—	—	—	7 : 1

A Merchant in London remits to Rotterdam 375 l. 10 d. Sterling, at 34 s. 8. Flemish for 20 Shillings Sterling, How many Guilders Flemish must be paid at Rotterdam, and what is gained per Exchange.

s.	s.	d.	lb.	s.	d.
20 Ster.	—	—	34 : 8 Flem.	what	375 : 10 :
	12			20	

416

7510

416

45060

7510

30040

Guilders : Stiver
fa. 3905 : 4.

2) 0 312416 | 0

2) 15620 | 8

2) 0 7810 | 4

3905

To

Chap. II. Questions in Exchange. 137

To find the *Gain* or *Loss* in one Pound, Subtract 33 s. 4 d. out of 34 s. 8 d. the Course of Exchange, the difference is 1 s. 4 d. *Flem.* per Pound, and so much *Gain* is the Course of Exchange in our Favour.

If the Course of the Exchange be under Par, it must by Parity of Reason become a *Loss* to us, and then the Course of Exchange is to our Prejudice.

The like is to be observed for the Coyns Exchanged in all other Countries.

I will give but one Example of *Loss* by Exchange, by which, with the foregoing Example of *Gain*, the ingenious may with ease travel through the General Course of Exchange with all Countries.

A Merchant in London remits a Bill of Exchange to Amsterdam for 297 l. 15 s. Sterling, at 31 s. 3 d. *Flem.* for 20 s. Sterling, I demand how much *Flemish* Money was paid for the said Bill in Amsterdam, and what is lost per Pound by the Exchange.

s.	s.	d.	l.	s.
20	31	:	3 <i>Flem.</i>	297 : 15 <i>Sterling.</i>

Guild. *Shill.*

Answer 2791 : 8 paid and
3 s. 1 d. *Flem.* er Pound lost by
the Exchange.

P R A.

PRACTICAL TABLE.

ls. d. l.	d. s.	lb. C. wt.
10—0— $\frac{1}{2}$	6— $\frac{1}{2}$	56— $\frac{1}{2}$
6—8— $\frac{1}{2}$	4— $\frac{1}{2}$	84— $\frac{1}{2}$
5—0— $\frac{1}{2}$	3— $\frac{1}{2}$	28— $\frac{1}{2}$
4—0— $\frac{1}{2}$	1— $\frac{1}{2}$	14— $\frac{1}{2}$
3—4— $\frac{1}{2}$	1— $\frac{1}{2}$	16— $\frac{1}{2}$
2—6— $\frac{1}{2}$		8— $\frac{1}{2}$
2—0— $\frac{1}{2}$		7— $\frac{1}{2}$
1—8— $\frac{1}{2}$		

I. When the given Price is Pence, take your parts in Shillings, the Product divide by 20, gives the Answer in Pounds.

OR, you may bring it into Pounds, at once, by cutting off the last Figure, and by considering that 240 Pence is one Pound, whereof 8 d. is $\frac{1}{30}$ 6 d. is $\frac{1}{40}$ 4 d. is $\frac{1}{60}$ 3 d. is $\frac{1}{80}$ 2 d. is $\frac{1}{120}$.

Example 1.

1	T	254 lb of Tobac.	d	716 Ells at 3 d.
		— (co at 1 d.	s. d.	— s. d.
1	T	2 1 : d.	380	L. 8 : 19 : 0 facit.
		—		—
1	L	1 : 1 : 2 facit.	d	215 lb. at 4d.
		—	s. d.	— s. d.
d	2	254 lb. at 2d.	400	L. 3 : 11 : 8 facit.
		—		—
2	L	4 2 : 4	d	643 Gall. at 6 d.
		—	600	—
1	L	2 : 2 : 4 facit.		L. 16 : 1 : 6 facit.
		—		—

The

Chap. 12. *Rules of Practice.*

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The three last Examples are brought into Pounds at one Operation, after which manner any Sum in Practice may be readily cast up.

Here you see that 254 lb. of Tobacco at 1 d. a Pound, divided by the $\frac{1}{2}$ gives 21 s. 2 d. and that divided by 20 (by cutting off the last Figures and taking $\frac{1}{2}$ of it) gives 1 l. 1 s. 2 d. the Price of 254 lb. of Tobacco ; and for 2 d. a lb. take the $\frac{1}{2}$; because 2 d. is the $\frac{1}{2}$ part of a Shilling, and for 3 d. a lb take $\frac{1}{4}$; and so for the others at 4 d. and 6 d.

11. When the given Price are such Pence as are no even part of a Shilling, take first the greatest even part of a Shilling, and then part of that part ; add them together, and divide the Product by 20, or cut off the last Figure and take $\frac{1}{2}$.

d.		2121 Ells at 5 d.			784 lb. at 7 d.
4	$\frac{1}{3}$	707		6	392
1	$\frac{1}{4}$	176 : 9 d.		1	65 : 4 d.
5		88 3 : 9		1	45 7 : 4 d.
		44 : 3 : 9 facit.			22 : 17 : 4 facit

245 lb

254 lb. of Tobacco at 9 d. and 10 d. $\frac{1}{2}$ a lb.

d.	127
6 $\frac{1}{2}$	63 : 6
3	
9	19 0 : 6
2	
4	9 : 10 : 6 fa.

d.	254 at 10 d. $\frac{1}{2}$.
6	127 shill. in 254 six pence.
4	84—8 in 254 groats.
16	7 in 254 half pence.
5	3 $\frac{1}{2}$ in 254 farthings.
	22 7 : 6 $\frac{1}{2}$
	11 7 : 6 $\frac{1}{2}$ fa.

Demonstration. In 254 lb. of Tobacco at 10 d. $\frac{1}{2}$ a lb. there must be 254 sixpences, which is 127 Shillings and 254 Groats, which is 84 s. 8 d. and 254 Half-pence, which is 10 s. 7 d. and 254 Farthings, which is 5 s. 3 d. $\frac{1}{2}$, all these added together, make 227 s. 6 d. $\frac{1}{2}$, which divided by 20, gives the facit, 11 l. 7 s. 6 d. $\frac{1}{2}$.

	614 lb. at 11 d
6	307
4 $\frac{1}{2}$	204 : 8 d.
1 $\frac{1}{4}$	51 : 2
11	56 2 : 10
	28 12 : 10 facit.

	563 lb. at 12 d. $\frac{1}{2}$
6	281 : 6 d.
4 $\frac{1}{2}$	187 : 8
1 $\frac{1}{4}$	70 : 4 $\frac{1}{2}$
	53 9 : 6 $\frac{1}{2}$
	26 : 19 : 6 $\frac{1}{2}$ facit.

III. If the given Price be any Number of Pence above 1 s. and less than 2 s. take the Aliquot parts in Pence, (as in the last precedent) to which add the given Quantity for the 1 s. and proceed as before.

Example

Chap. 12. Rules of Practice.

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12 in 40 s. is 3 times, and there rests 4 s. which I turn into Pence, and it makes 48 Pence; then 12 in 48 is 4 times. And the Facit is 36 l. 3 s. 4 d.

V. If the given Price be such Shillings and Pence as are no even parts of a Pound, Multiply the given Quantity by the Number of Shillings, and take the Aliquot parts of Pence, and proceed according to the Second Rule of this Chapter.

Ells	
375 at 8 s. 6 d.	
8	
3000	
187 : 6	
318 7 : 6	
159 : 7 : 6 fact.	

Ells.	
493 at 15 s. 10 d.	
15	
2465	
493	
246 : 6 d.	
164 : 4	
780 5 : 10	
390 : 5 : 10 fact.	

C.

	C.	s.	d.
	295	at 12—9	
	12		
$\frac{1}{2}$	3540		
	147	: 6	
	73	: 9	
	376	1 : 3	
	188	: 1 : 3	facit.

	C.	s.	d.
	214	at 7—11	
	7		
	1498		
	107		
	53	: 6	
	35	: 8	
	169	4 : 2	
	84	: 14 : 2	facit.

VI. If your given Price be any Number of Pounds, Shillings, and Pence. Reduce first your Pounds and Shillings into Shillings, and proceed according to the last Rule.

	Pieces	l.	s.	d.
	754	at 4—03—7		
	83	20		
$\frac{1}{2}$	2262	83		
	6032			
	377			
	62	: 10		
	6302	1 : 10		
	3151	: 1 : 10		facit.

	Tun.	l.	s.	d.
	176	at 3—07—10		
	67	20		
	1232	67		
	1056			
	11792			
	88			
	58	: 8		
	1193	8 : 8		
	596	: 18 : 8		facit.

VII. If your given Price be any Number of Pounds, and exceeding five Pound, then Multiply your given quantity by the Number of the Pounds, and take your Aliquot part in Shillings and Pence, viz.

	C.	l.	s.	d.		bhead.	l.	s.	d.
	74	at	11-12-6			394	at	16-16-8	
	11					16			
s.	814					2364			
10	37		d.			394			
2	9:5:0					197			
						98:10			
	860:5:0	facit.				24:12:6			
						8:4:2			
						6632:6:8	facit.		

VIII. If the given Quantity be any Number of C. qrs. or lb. or Tun C. qrs. and lb. &c. work as before where no part is, and take your Aliquot parts in Quarters and Pounds, or in C. qrs. and lb. and add them to your first Work. An Example or two will make this plain.

C.	s.	d.	C.	s.	d.
75 $\frac{1}{2}$ at 22 : 6			63 $\frac{1}{2}$ at 12 : 10		
22			12		
	11 : 3			6 : 5	
150			756	3 : 2 $\frac{1}{2}$	
150			31 : 6		
37 : 6			21 : 0	9 : 7 $\frac{1}{2}$	
11 : 3			9 : 7 $\frac{1}{2}$		
169 8 : 9			81 8 : 1 $\frac{1}{2}$ facit.		
84 : 18 : 9 facit.					
			40 : 18 : 1 $\frac{1}{2}$ facit.		

In the Example of 63 C. $\frac{1}{2}$ at 12 s. 10 d. the C. weight, I multiply the C. by 12 s. and take the parts in Pence for the odd Pence; then for the $\frac{1}{2}$ of a C. I first take the $\frac{1}{2}$ of the price of a C. and that makes 6 s. 5 d. the price of $\frac{1}{2}$ a C. and then I take the $\frac{1}{2}$ of that, which gives 3 s. 2 d. $\frac{1}{2}$, the price of a qr. of a C. Add them together, it gives the price of $\frac{1}{2}$ of a C. which is 9 s. 7 d. $\frac{1}{2}$, and must be added to your first Work. Two or three Examples more will make it familiar and easie to any Capacity.

84 C. 3 qrs. 11 lb. at ———	21 s. 10 d.
21	
84	$\frac{1}{2}$ 10 : 11
168	$\frac{1}{2}$ 5 : 5 $\frac{1}{2}$
42	7 $\frac{1}{2}$ 1 : 4 $\frac{1}{4}$
28	4 $\frac{1}{2}$ 0 : 9 $\frac{1}{4}$
18 : 6	18 : 6
185 2 : 6	the price of
	3 qrs. 11 lb.
92 : 1216 facit.	

the
the
the $\frac{1}{2}$
and
then
the
gives
and
three
sic to

Tim. C. qr. lb. l. s. d.
12 : 14 : 3 : 14 at 15 : 17 : 06 a Tim.

	12
	190 : 10 : 00
$\frac{1}{2}$	7 : 18 : 9
$\frac{1}{4}$	3 : 3 : 6
$\frac{1}{8}$	0 : 7 : 11 $\frac{1}{4}$
$\frac{1}{16}$	0 : 3 : 11 $\frac{1}{2}$
$\frac{1}{32}$	0 : 1 : 11 $\frac{1}{2}$

Facit 302 : 06 : 1 $\frac{1}{2}$

C H A P. XIII.

The Order of Deducting TARE and TRET.

GROSS is the Weight of a Commodity, with the *Hogsheads, Chests, Box, or whatever else contains it.*

TARE is the Allowance given for the Weight of the Cask, Hogshead, &c.

TRET is an Allowance of 4 lb. in a 104 lb. for waste and dust on some sort of Goods.

	C.	qr.	lb.	lb.	lb.
Ex. 11 bbls. qt.	45	3	15	Gross	Tare 14 per 112
	14	1	10		how many lb. Neat?
	5	2	26	Tare.	

Facit 40-0-17 Neat.

I. Here 14 lb. *Tare* being $\frac{1}{8}$ of 112 lb. take $\frac{1}{8}$ of the *Gross*, the Quotient gives the whole *Tare*, which subtract from the *Gross*, gives the *Neat* weight.

The Operation is performed thus, Divide the *Gross* by 8, say, 8 in 45, 5 times, and 5 C. remains, which is 20 qrs. and 3 is 23; then 8 in 23, 2 times, 7 qrs. remains, which turned into Pounds by 28, and added to the 15 lb. makes 211 lb. then 8 in 211 is 26 times. So the *Tare* is 5 C. 2 qr. 26 lb.

Example

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Example. C. gr. lb. *Neat* at 22 : 6

40 : 0 : 17	lb.	22 : 6
22	lb.	14 $\frac{1}{8}$
80	2 $\frac{1}{2}$	0 : 4 : $\frac{1}{4}$
80	1 $\frac{1}{2}$	0 : 2 : $\frac{1}{4}$
20		
3 : 4 $\frac{1}{2}$		facit 3 : 2 : $\frac{1}{4}$
90 3 : 4 $\frac{1}{2}$		price of 17 lb.
49 : 3 : 4 $\frac{1}{2}$		

If the *Tare* be 16 lb. in 112 lb. take $\frac{1}{7}$ of the *Gross*, and work as before.

If 18 lb. per 112 lb. for *Tare*, take the Aliquo parts, viz.

for 16 lb take the $\frac{1}{7}$ } Add the *Tare* of 16 and the
for 2 take the $\frac{1}{7}$ } *Tare* of 2 together, the
total subtract from the *Gross*, and work
as before.

lb. lb. lb.
If 20 in 112 for *Tare* } for 16 take $\frac{1}{7}$ lb.
for 4 take $\frac{1}{7}$ of 16

11. When an Allowance is made for *Tret*, then (after the *Tare* is subtracted from the *Gross*) the remainder is called *subtle*, which divide by 26, because 4 lb. is the 26th part of 104 (the Allowance always given for *Tret*) the Quotient gives the *Tret*, which subtracted from the *subtle*, gives the *Neat* weight.

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C. gr. lb. lb. lb. lb.
 Ex. 45 : 3—15 Gr. Tare 16 in 112 Tret 4 in 104
 16½ 6 : 2 : 6 Tare.

39 : 1 : 9 Subtle.

4) 104

— 4

— 26

257
28

1265

314

26) 4405

— 180

4405 pound subtle.
169 Tret.

169 245

11

4236 Neat pound at 6 d.

6½ 211½ d.

10978—0 facit.

— III. If the Allowance for Tare be 8 lb, 10 lb, 12 lb, in 112, or any other lesser Number, whether an Aliquot part of 112 or not, in such cases, divide the Gross into two parts by 2, which will make it half hundreds, then say, 8 is $\frac{1}{7}$ of $\frac{1}{2}$ C. or if 12 lb in 112 lb.

8½ When you have found your Tare, subtract it 4½ always out of the whole Gross.

I might enumerate Examples, but these being sufficient to instruct any ordinary Capacity in Tare and Tret.

I shall proceed to shew some other abbreviated ways of casting up Goods and Merchandize.

CHAP.

C H A P. XIV.

For Retailers of small Parcels, as Merchants, Linnen, and Woollen Drapers, Haberdashers of Hats, &c.

THE most Abbreviated and ready way is to multiply the Price by the Quantity.

Ex. Sold 7 Yards of Cloth at 14 : 6 a Yard.

$$\begin{array}{r} 14 : 6 \\ \times 7 \\ \hline \text{facit } l. 5 : 2 : 6 \end{array}$$

Say 7 times 6 is 42, which is 3 s. 6 d. set down 6 d. and carry 3 s. to the place of Shillings, and say, 7 times 4 is 28, and 3 I carry is 31, set down 1 s. and carry 3 Angel to the place of Tens of Shillings, and say, 7 times 1 is 7, and 3 I carry is 10 Angel, which 5 l. set a (o) in the place of Shillings, and fix the 5 l. in the place of pounds, so the price of 7 Yards is 5 l. 1 s. 6 d.

Ex. 2. Sold 11 $\frac{1}{2}$ Yards at 13 : 03

$$\begin{array}{r} 13 : 03 \\ \times 11 \frac{1}{2} \\ \hline 7 : 05 : 09 \\ 6 : 07 : \frac{1}{2} \\ \hline \text{Facit } l. 7 : 12 : 04 \frac{1}{2} \end{array}$$

For half a Yard take half of 13 s. 3 d. and add to the Product of 11 Yards.

G 4

Ex.

Ex. 3. Sold 14 $\frac{1}{2}$ Yards at 1 : 07 : 10

$$\begin{array}{r}
 \text{l.} \quad \text{s.} \quad \text{d.} \\
 1 : 07 : 10 \\
 \hline
 9 : 14 : 10 \\
 \hline
 2
 \end{array}$$

$$\begin{array}{r}
 19 : 09 : 08 \\
 \frac{1}{4} - 1 - 00 : 13 : 11 \\
 \frac{1}{4} - 1 - 00 : 03 : 05 \frac{1}{4} \\
 \hline
 \text{Facit l. } 20 : 07 : 00 \frac{1}{4}
 \end{array}$$

Find the first Price of 7 Yards, *fa.* 9 l. 14 s. 10 d. which multiplied by 2, gives 9 l. 9 s. 8 d. the price of 14 Yards, then take the Aliquot parts of $\frac{1}{4}$ for the Price of one Yard, as you see in the Operation : The *facit* is 20 l. 7 s. 0 d. $\frac{1}{4}$.

Ex. 4. Sold 7 C. $\frac{1}{2}$ of Currants at 2 : 13 : 6

$$\begin{array}{r}
 \text{l.} \quad \text{s.} \quad \text{d.} \\
 2 : 13 : 6 \\
 \hline
 18 : 14 : 6 \\
 \hline
 1 : 06 : 9
 \end{array}$$

Facit 20 : 01 : 3

Object. There are many Numbers under 100 that are not included in the Multiplication Table, or being multiplied together, will not produce the given quantity ; and so consequently cannot be done by this new way of Practice.

Ans.

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Ans. It's very true, there are several Numbers under 100, that no two Numbers multiplied together can produce them, such as 13, 17, 19, 26, 29, 31, 34, 37, and many more.

Rule. In such cases multiply by two such Numbers as being multiplied together, will come nearest to such odd Numbers, then multiply the price by that part which wants to make up the given quantity. An Example of which follows.

	<i>s.</i>	<i>d.</i>	
5. Ex. 29 Ells at 7 :	9		Here I multiply by
	7		7 and 4, because 7
	—	—	times 4 is 28, and for
2—14 :	3		the odd Ell to make it
	4		29, I add the price of
	—	—	the Ell to the Product,
10 :	17 :	0	<i>fa.</i> 11 l. 4 s. 9 d.
	7 :	9	
	—	—	
<i>facit</i> 11 :	04 :	9	

Example 6. If 34 Ells at the same price multiplied by 8 and 4, makes 32, and multiply the price of one Ell by 2, and add that to the Product, makes 34.

7 Example. $\begin{matrix} \text{O. gr. lb.} & \text{l.} & \text{s.} & \text{d.} \\ 19 : 3 : 7 & \text{at} & 4 : 15 : 06 \\ & & & 5 \end{matrix}$

$23 : 17 : 06$

3

$71 : 12 : 06$

$2 : 07 : 09$

$1 : 03 : 10 \frac{1}{2}$

$5 : 11 \frac{1}{2}$

$l. 75 : 10 : 01 \text{ facit.}$

Goods Sold by } 1. Account 2s. 4d. for every
 112 lb. the } Farthing in the place of 1 pound
 C. weight. } weight.

$\begin{matrix} \text{d.} & \text{lb.} \\ \text{Ex. 1. At } 3 \frac{1}{2} & \text{the Pound, what } 112 \end{matrix}$

$\begin{matrix} 14 & 32 : 8d. \\ 2. \text{ Or multiply the Pence that 1 Pound weight} \\ \text{cost by 7, and divide by 15 the Quotient is the} \\ \text{price in Pounds of a hundred weight.} \end{matrix}$

Ex. At 5d. the Pound, what cost 112?

$\begin{matrix} 7 & \text{Say, 15 in 32, 2 times, rest 5,} \\ \text{which is 100 Shillings, then 15 in} \\ 15) 35 & 100, 6 times, rest 10, it makes \\ \text{---s.d.} & 120d. then 15 in 120 is 8 times, \\ \text{facit l. 2-6 8} & \text{facit 2l. 6s. 8d.} \end{matrix}$

3. Multiply the Pounds in Money that 112 cost by 15, and divide the Product by 7, the Quotient gives the Price 1 Pound cost.

If

lb. $l.$ $s.$ $d.$ lb.
 If 112 cost 2 : 06 : 8 what cost _____

$$\begin{array}{r}
 5 \\
 \hline
 11 : 12 : 4 \\
 \hline
 3
 \end{array}$$

$$\begin{array}{r}
 7 \overline{) 35 : 00 : 0} \\
 \text{facit } 5 \text{ pence.}
 \end{array}$$

Goods sold } 4. Multiply the pence that 1 lb. cost
 to 100 } by 5, and divide by 12, the Product
 is the price in Pence.

At 15 $d.$ the Ounce, what cost 100 Ounces?

$$\begin{array}{r}
 5 \\
 12 \overline{) 75}
 \end{array}$$

facit 1 $l.$ 6 : 5 $s.$

5. Multiply the Pounds in Money 100 lb. weight
 cost by 12, and divide by 5, the Quotient gives
 in pence the price of 1 Pound.

lb. $l.$ $s.$ lb.
 If 100 cost 6 — 5 what cost 1 ?

$$\begin{array}{r}
 12 \\
 \hline
 5 \overline{) 75 : 00} \\
 15 : 00
 \end{array}$$

facit 15 $d.$

Things sold by 120, such as Deals, &c.

6. Multiply the Pence that 1 cost by 2, and di-
 vide by 4, the Quotient is the price of 120.

What

^{d.}
What cost 120 Deals at 13 the Deal-board?

$$\begin{array}{r} 2 \\ 4) 26 \end{array}$$

facit 6 : 10

7. Or divide the Pence that one is worth by 2 the Quotient will be Pounds.

What cost 120 Yards of Ribbon at 5 d.

facit 2 l. 10 s.

8. For things sold by 200, annex only a Cypher to the Sum of the given Price.

What cost a Bale of Paper, quantity 200 Reams, at 6 s. a Ream? *Facit 60 l.*

Wine or Oyl sold by the Tun of 252 Gallons.

9. So many Pound the Tun cost, abate so many Shillings, and the Gallon will be worth so many Pence.

Ex. If 252 Gallons cost 25 l. what cost 1 Gallon?

$$\begin{array}{r} 1 : 5 \end{array}$$

$$\begin{array}{r} 23 : 15 \end{array} \quad \begin{array}{r} s. \quad d. \\ \text{facit } 1 : 11 \frac{1}{2} \end{array}$$

Here 20 s. is valued at 1 penny, so that 23 l. 15 s. is but 1 s. 11 d. $\frac{1}{2}$. the price of 1 Gallon of Oyl.

10. For things sold by 300, annex a Cypher to the price of one, take half, and add them together.

What cost 300 Chaldron of Coals at 25 s.

$$\begin{array}{r} 250 \\ 125 \end{array}$$

$$\begin{array}{r} 375 \end{array}$$

11. For things sold by 500, put a Cypher to the price, then double it, take half, and add the two last together.

What

Chap. 14. *Short Ways to cast up* 157

What cost 500 Quarters of Corn, at 31 s. a Quarter?

310 s.

2

620

155

facit 775 Pound.

12. For things sold by 900, put a Cypher and treble it.

What cost 600 Hats at 9 s.

90

3

facit 270 Pound.

13. For things sold by 600, put a Cypher, treble it, take half, and add the two last together.

What cost 700 Gallons at 11 s.

110

3

330

55

facit 385 Pound.

There are abundance of other short ways, which cannot well be comprised in this little Tract: These already given are sufficient for any ingenious inventive Head to lay a good Foundation, from whence he may raise what Structure he please.

C H A P.

CHAP. XV.

INTEREST is either *Simple* or *Compound*.

Simple Interest is that which ariseth or is computed from the Principal only. And here all Questions are done by the Double Rule of Three (called the Compound Rule of five Numbers) or Practice.

Example. What will the Interest of 275 l. 11 s. 3 d. come to for a Year, at 6 l. per Cent.

State your Question by the Rule of Three, and say,

l. l. s. d.
If 100 gain 6, what will 275 : 11 : 3

l. 16 | 53 : 07 : 6

s. 10 | 67 : 20

12

l. s. d.
facit 16 : 108 : 1 $\frac{10}{12}$ d. 8 | 10

Here 275 l. 11 s. 3 d. Principal is multiplied by 6 l. (the Interest) being the middle Number, and divided by 100 the first Number by cutting off two Figures in the Dividend, rest 53 l. which multiplied by 20, gives 1067 shillings, which divided again by 100 as before, rest 67 s, which multiplied by 12, and divided at

15.

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 as before gives *facit* 16 l. 10 s. 8 d. the Interest
 for 1 Year.

or

$$\begin{array}{r}
 \text{l.} \quad \text{s.} \quad \text{d.} \\
 275 : 11 : 3 \text{ for a Year at } 5 \text{ l. per Cent.} \\
 \hline
 5 \\
 \hline
 13|77 : 16 : 3 \\
 \hline
 20 \\
 15|56 \\
 \hline
 12 \\
 6|75 \\
 \text{facit } 13 : 15 : 16 \frac{7}{10}
 \end{array}$$

1 s.

and

$$\begin{array}{r}
 \text{l.} \quad \text{s.} \quad \text{d.} \\
 275 : 11 : 3 \text{ at } 5 \frac{1}{2} \text{ per Cent.} \\
 \hline
 5 \\
 \hline
 1377 : 16 : 3 \\
 \frac{1}{2} 137 : 15 : 7 \frac{1}{2} \\
 \hline
 15|15 : 11 : 10 \frac{1}{2} \\
 \hline
 20 \\
 3|11 \\
 \hline
 12 \\
 1|42 \\
 \hline
 4 \text{ l.} \quad \text{s.} \quad \text{d.} \\
 1|70 \text{ facit } 15-3-1 \frac{1}{4} \frac{7}{10}
 \end{array}$$

6

lti-
dle
by
eft
hil-
re,
led
at

What comes the Insurance of 975 l. 13 s. 4 d.
 to, at 4 Guinea's per Cent.

l. s. d.
975 : 13 : 4
4 : 6 s.

3902 : 13 : 4
5 $\frac{1}{4}$ — 243 : 18 : 4
1 $\frac{1}{4}$ — 48 : 15 : 8

41|95 : 07 : 4 l. s. d.
— 20 facit 41 : 19 : 0 $\frac{3}{4}$ $\frac{11}{16}$
19|07
— 12
00|88
— 4
3|52

l. s. d.
275 : 11 : 3 at 5 per Cent. for 14 Months.

l. s. d.
The Int. of 1 Year is 13 : 15 : 06
2 Months $\frac{1}{3}$ — 2 : 5 : 11

facit 16—01—05 Int. for 14 m.

l. s. d.
275 : 11 : 3 at 5 per Cent. for 3 Years, 5 Months,
20 Days.

The

	<i>l.</i>	<i>s.</i>	<i>d.</i>
The Interest of a Year is	13	15	06
which multiplied by the 3			3
Years, and take Aliquot			
parts for 3 Months and 20	m. 41	6	6
Days, as you see in the	4 $\frac{1}{2}$	4	11—10
Operation	1 $\frac{1}{2}$	1	2—11 $\frac{1}{2}$
days	10 $\frac{1}{2}$	0	7—7 $\frac{1}{2}$
	10 $\frac{1}{2}$	0	7—7 $\frac{1}{2}$
produces fact	47	16	7

The way used by Bankers for casting up Interest is generally by days, thus,

They bring the Principal Money into Pence, and multiply it by the Days it is out at Interest, and divide by 6083 for 6 per Cent. And 7300 for 5 per Cent: (which are the Days of a Year multiplied by 100, and divided by the rate of Interest) An Operation in the Compound Rule of five Numbers, viz.

If 100 *l.* in 365 days gain 6 *l.* Interest, what will 75 *l.* gain in 94 days?

Example

Example. $\begin{matrix} l. & s. & d. \\ 275 & 11 & 3 \\ 20 \end{matrix}$ at Interest 70 Days at (6 per Cent.

— 12) - 761 pence (6) 36500

95-22

12

6/3 : 5

6082

66125

70

fac. 3 4 : 5

60837 4629450

37135

761

6270

287

Example. 1000 lb. at int. for 75 days at 4 per C.

20

facile 20 s. d.

2000

12

265

100

24000

75

5) 36500

120000

168000

7300

18000/00

73|00|18000|00

-340

12) 246 | 480

facit 20 : 6 : 42

C H A P. XVI.

Compound Interest is that which arises from the Principal, and also from the Interest thereof, and therefore is called Interest upon Interest.

THIS sort of Interest is counted very unlawful, and is seldom or never allowed, but by particular Contract or Valuation of Money sometimes on Purchases.

The best way of working this sort of Interest is by Decimals.

Example. 275 l. 11 s. 3 d. forborn 5 years, at 6 per Cent. per Annum, Interest upon Interest, what will the same amount to?

Reduce the 11 s. 3 d. into a Decimal Fraction, according to the Third Rule of the Eighteenth Chapter of this Book.

11 s. 3 d. $\frac{1}{4}$ of a Pound Sterling.

which brought into a Decimal Fraction, is 5625, the Operation of the Question is, viz.

If 100 gain 6, what will 275, 5625 — 6
16, 5337

1 Year — 292, 0962 — 6
17, 5257

2 Year — 309, 6219 — 6
18, 5773

3 Year — 328, 1992 — 6
19, 6919

4 Year — 347, 8911 — 6
20, 8734

5 Year — 368, 7645 — 6

Facit 368 l. 15 s. 4 d.

Here the third Number is multiplied by 6, the Second Number, and divided by 100. the first Number, which is done by setting out the two first Figures towards the Right hand, and casting them away as you multiply them, to abbreviate the work of Multiplications, which would be very large, were they all set down, where 25, or more Years Interest is forborn, besides 4 or 5 places of Decimals will be correct to a Farthing, or little more, so that the *facit* makes 368 l. 15 s. 4 d. the Decimal Fraction being valued according to the sixth Rule of the eighteenth Chapter of this Book.

C H A P.

C H A P. XVII.

Rebate or Discount is when a Sum of Money due at any time to come, is satisfied by the Payment of so much present Money, as being put forth at a certain Rate of Interest for the time being, will be equal to the Sum first due.

IN *Rebate*, 12 Months is the *first* Number, the Rate of Interest the *second*, and the time proposed the *third* Number.

Then say, If 100, and that *facit* (added together) abate that *facit*, what shall the given Sum *Rebate*?

The Quotient or Quotients shew the *Rebate*; which subtracted out of the given Sum, shews the Money to be paid presently.

Exam. What will the *Rebate* of 795 *l.* 11 *s.* 2 *d.* come to for 11 Months, at 6 *l.* per Cent.

If 12 Months give 6 *l.* what will 11 Months? *facit* 5 *l.* 10 *s.* Then

If 105 *l.* 10 *s.* *Rebate* 5 *l.* 10 *s.* what will 795 *l.* 11 *s.* 2 *d.* *facit* 41 *l.* 9 *s.* 5 *d.*

Exam. 2. The *Rebate* of 765 *l.* 11 *s.* 2 *d.* come to for 17 Months at 6 per Cent.

If 12 Months give 6 *l.* what will 17 Months? *facit* 8 *l.* 10 *s.*

If 108 *l.* 10 *s.* *Rebate* 8 *l.* 10 *s.* what 795 *l.* 11 *s.* 2 *d.* *facit* 62 *l.* 6 *s.* 5 *d.*

Exam-

Exam. 3. Sold Goods for 795 *l.* 11 *s.* 2 *d.* to be paid at 2, 3 Months (that is half at 3 Months, and the other half at 3 Months after that) If all the Money be paid presently, what must be discounted?

First, Divide the given Sum into two parts according to the time of Payment, as you see here; Then say,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 12 Months give 6 <i>l.</i> what	795	11	2
will 3 Months? <i>facit</i> 1 <i>l.</i> 10 <i>s.</i> 2)	397	15	7

If 101 *l.* 10 *s.* abate 1 *l.* 10 *s.* what will 397 *l.* 15 *s.* 7 *d.* *facit* 5 *l.* 17 *s.* 6 *d.*

If 12 Months give 6 *l.* what will 6 Months give? *facit* 3 *l.*

If 103 *l.* abate 3 *l.* what will 397 *l.* 15 *s.* 7 *d.* *facit* 11 *l.* 11 *s.* 8 *d.*

Add the Sum of the Rebates together, and subtract it out of the given Sum, gives the Money to be paid presently.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
			795 : 11 : 2
397 : 15 : 7 for 3 Months	5	17	6
397 : 15 : 7 for 6 Months	11	11	8

All the Rebate 17 : 09 : 2

The Money to be paid presently 778 : 02 : 0

Exam.

Chap. 16. Rebate or Discount. 167

Exam. 4. Sold Goods for 795 l. 11 s. 2 d. to be paid at 3, 2 Months, if all the Money be paid presently, what must be discounted?

Divide the given Sum into three parts, and work as before, *facit* 15 l. 10 s. 11 d. $\frac{1}{2}$.

Ex. 5. Sold Goods for 795 l. 11 s. 2 d. to be paid at 4, 1 Months, if all the Money be paid down, what must be discounted? *fa.* 9 l. 15 s. 9 d. $\frac{1}{4}$.

Divide your Money into four payments, then work as before, *viz.*

12 mo. — 6 l. — 1 mo. — *facit* 10 s.
100 l. 10 s. abate 10 s. what will 198 l. 17 s. 9 d.
facit 19 s. 9 d.

12 mo. — 6 l. — 2 mo. — *facit* 1 l.
101 l. — 1 l. — 198 l. 17 s. 9 d. *fa.* 1 l. 19 s. 4 d.

12 mo. — 6 l. — 3 mo. — *facit* 1 l. 10 s.
101 l. 10 s. abate 1 l. 10 s. what 198 l. 17 s. 9 d.
facit 2 l. 18 s. 9 d.

12 mo. — 6 l. — 4 mo. — *facit* 2 l.
102 l. abate 2 l. what will 198 l. 17 s. 9 d.
facit 3 l. 17 s. 11 d.

l.	s.	d.
0	: 19	: 9
1	: 19	: 4
2	: 18	: 9
2	: 17	: 11
1	: 15	: 9

l.	s.	d.
795	: 11	: 2
rebated	9	: 15 : 3
Facit	785	: 15 : 9
to be paid down.		

C H A P. XVIII.

F R A C T I O N S

Are of Two kinds $\left\{ \begin{array}{l} \text{V U L G A R} \\ \text{and} \\ \text{D E C I M A L} \end{array} \right.$

A VULGAR FRACTION is caused by Division of whole Numbers, the Remainder of which being less than the Divisor, called the Numerator, is always the Dividend, and the Denominator is the Divisor.

$\frac{3}{4}$ Numerator.
Denominator.

A DECIMAL FRACTION is such a one, whose Denominator is understood, and therefore need not be expressed : And is an *Unit* with as many Cyphers following it, as there be Figures and Cyphers in the Numerator.

Decimal Fractions, whether they stand alone, or be joyned with Integers, have always a Comma or Point before them to distinguish 'em from Integers ; as 5 36 0042.

In *Decimals* the value of every Figure or Cypher decreases by a Ten-fold Proportion from the Units place towards the *right hand*, as the whole

whole Numbers do increase the value towards the left hand, by the like Proportion, as you may see in the following Table.

C. Thou.	X. Thou.	Thou.	C.	X.	Unites.
6	5	4	3	2	1
whole Numbers,					

Tenths.	Hund.	Thou.	X. Thou.	C. Thou.
2	3	4	5	6
Decimals,				

Cyphers before Integers, and at the end, or right hand of Decimals are of no value, but after Integers and before Decimals they have their value, for in Integers they increase, and in Decimals they diminish the value of the other Figures joyned with them.

In Integers 005 is but 5, and 004 is but 4, and 06 is but 6.

But in Decimals, ,005 is $\frac{5}{1000}$, and ,034 is $\frac{34}{1000}$, and ,06 is $\frac{6}{100}$.

And again, in Integers 500 is five hundred, and 400 is four hundred.

In Decimals 500 is but 5, and 400 is but 4, &c.

Next to Abbreviation and Valuation of *Vulgar Fractions*; there is little required, but to know how to bring a *Fraction* of a lesser Name into the *Fraction* of a greater Name: And to reduce *Fractions* of divers unequal *Denominators* to one common *Denominator*, which being well understood, you may with as much ease *Add*, *Subtract*, *Multiply* and *Divide* a *Fraction*, as you can a whole Number.

In *Decimals* a Fraction is seldom abbreviated, therefore,

1. To abbreviate any *Vulgar Fraction*, find such a Number for dividing both the Numerator and Denominator thereof, so that no remainder be on either of the Divisions.

Ex. Abbreviate $2\frac{5}{12}$ into $\frac{5}{3}$ its lowest term.

Say, 12 in 96, 8 times, and 12 in 120, 10, then the Fraction is $\frac{5}{3}$, then say, 2 in 8, 4 times, and 2 in 10, 5 times, then the Fraction is $\frac{5}{3}$, so that 4 is to 5, as 96 to 120.

2. To know what part of a Pound Sterling any Number of Shillings and Pence are, bring the Shillings and Pence into Pence for a Numerator, and place 240 under it, (the Pence of one Pound) for a Denominator.

Exam. What part of a l. is 11 s. 3 d.

$$\frac{11\frac{3}{4}}{1\frac{3}{4}} \text{ facit } \frac{1\frac{3}{4}}{1\frac{3}{4}}$$

3. To Reduce *Vulgar Fractions* into *Decimals*, Add Cyphers at pleasure to the Numerator, and divide by the Denominator. *Example, viz.*

Reduce 11 s. 3 d. into a Decimal Fraction.

$$\begin{array}{r} 12 \\ \hline 135 \\ \hline 240 \end{array}$$

$$\begin{array}{r} 24 \overline{) 1350000} \\ \underline{150} \\ 60 \\ \underline{120} \\ 0 \end{array}$$

facit, 9625

Ex-

Exam. Reduce $\frac{1}{2}$ into a Decimal Fraction.

$$\begin{array}{r} 5) 4000 \\ \hline \end{array}$$

,800

facit ,800

4. To value a Vulgar Fraction, Multiply the Integer into the Numerator, and divide by the Denominator.

What is the $\frac{1}{2}$ of a Pound Sterling?

20 s.

5

8 | 100 d.

facit 12 6

s. d.

An Ell worth 7 : 9 what is $\frac{2}{3}$ worth

2

$$\begin{array}{r} 5) 15 : 6 \\ \hline \end{array}$$

facit—3 : 1 $\frac{1}{3}$

5. To value a mixt Number, Multiply the mixt Number by the Numerator, and Divide by the Denominator. Exam. viz.

l. s. d.

A Ship worth 794 : 11 : 9 what is $\frac{1}{3}$ worth?

3

$$\begin{array}{r} 8) 3972 : 18 : 9 \\ \hline \end{array}$$

facit 496 : 12 : 4 $\frac{1}{2}$

6. To value a Decimal Fraction expressing Coin, every Prime or Unit in the first place is 2 s. value, every 5 in the second place is 1 s. and the rest Farthings but if they exceed $\frac{2}{5}$, there must be one Farthing abated.

Reduce $\frac{7}{2}$ of a Pound into a Decimal Fraction.

9) 700000

77777

Here 7 Primes is 14 s. and 8 taken out of the second place is 1 s. which makes 15 s. then 2 remains, which is 27, to the thirds, or place of Farthings, out of which abate 1 for $\frac{2}{5}$, it makes facit 15 s. 6 d. $\frac{1}{2}$, which is the $\frac{7}{2}$ of a Pound Sterling.

7. To Reduce Vulgar Fractions to a Common Denominator, Multiply the Numerator of each Fraction into every Denominator, except its own, which makes that Product a new Numerator; then multiply all the Denominators continually together, and that Product is a Common Denominator to all the new Numerators. Example, viz.

Reduce $\frac{1}{2}$ and $\frac{1}{3}$ to a Common Denominator.
facit $\frac{3}{6}$ and $\frac{2}{6}$.

Here 12 is the Common Denominator to both the New Numerators, viz. 8 and 9, and you find that 8 is to 12, as 2 to 3, and 9 is to 12, as 3 to 4.

So that $\frac{2}{11}$ is—to $\frac{1}{5}$ and $\frac{2}{11}$ —to $\frac{1}{4}$.

Reduce $\frac{1}{5}$, and $\frac{1}{4}$, and $\frac{2}{11}$ of a 1. to a Com. Denom.

4	18	40	42
6	8	4	4
24			
8	144	160	168
192	192	192	191

To prove your Work,
Divide your new Numerator by the Numerator of that Fraction, and Divide the Common Denominator of the Fraction by the Denominator, if both Quotients are equal, your Work is true.

Example. $\frac{144}{192} \div \frac{4}{4}$ here 144 divided by 3 makes 48, and 192 divided by 4, gives 48, which was to be proved. Or, you may prove your Work by Abbreviation of Fractions, but that is attended with much difficulty, where 4 or more Fractions are reduced to a Common Denominator.

Now this Reduction of Fractions is of little use, otherwise than to prepare a Fraction to be either Added, Subtracted, Multiplied, or Divided.

As if the $\frac{1}{5}$ and $\frac{1}{4}$ and $\frac{2}{11}$ were to be added together, Reduce them first into a Common Denominator, as in the last Rule, it makes $\frac{144}{192}$ and $\frac{160}{192}$ and $\frac{168}{192}$. Add all the new Numerators together, make 472, which divided by 192, the Common Denominator, makes $\frac{472}{192}$, as in the following Example.

Addition of } 144
 Vulgar Fra- } 160
 ctions. } 168

192) 472

l. s. d.

2) 88 facit $2\frac{88}{192}$, or $9 : 2$

And if the $\frac{3}{4}$ and $\frac{5}{8}$ and $\frac{7}{8}$ l. were to be added together in Decimals, reduce them first into Decimal Fractions, according to the Third Rule of this Chapter, and the Operation stands, viz.

0000

Addition of } $\frac{3}{4}$, 75 Say 4 in 30 is 7 times,
 Decimals. } $\frac{5}{8}$, 8333 and 4 in 20 is 5 times,
 } $\frac{7}{8}$, 875 and so for the rest.

l. s. d.

facit 2,4583 or, 2 : 9 : 2

By this Addition you see how much less work is made by Decimals than is in Vulgar Fractions, and how easie their Value is found out according to the Sixth Rule of this Chapter.

8. To Reduce (Compound Fractions, or) Fractions of a lesser Name into the Fractions of a greater, Multiply the Numerators together for a new Numerator, and the Denominators multiply together for a New Denominator.

Reduce $\frac{1}{4}$ of a Penny into the proper Fraction of a pound Sterling.

Say, $\frac{1}{4}$ of $\frac{1}{12}$, of $\frac{1}{20}$, or $\frac{1}{4}$ of $\frac{1}{240}$ facit $\frac{1}{960}$

9. To reduce a mixt number of a lesser Name into the Fraction of a greater. Reduce the mixt Number into an improper Fraction, and work as before:

Reduce

Reduce $3\text{ d. } \frac{7}{8}$ into the proper Fraction of a
 (pound Sterling.
 $\frac{7}{8}$ of $\frac{1}{2}$ of $\frac{1}{20}$, or $\frac{7}{8}$ of $\frac{1}{40}$, facit $\frac{7}{320}$.

By the same Rule you may Reduce any sort of Weight or Measure.

For Compound Fraction, their use is chiefly to bring Fractions of divers Denominations to one and the same Denomination.

As if the $\frac{1}{2}$ of a Penny, $\frac{1}{4}$ of a Shilling, and $\frac{7}{8}$ of a Pound were added together.

The $\frac{1}{2}$ of a Penny must be reduced into the Fraction of a Pound, and the $\frac{1}{4}$ of a Shilling, must be Reduced into the Fraction of a Pound thus,

$\frac{1}{2}$ of $\frac{1}{40}$ fa. $\frac{1}{80}$ } Then the Fractions to be
 $\frac{1}{4}$ of $\frac{1}{20}$ fa. $\frac{1}{80}$ } added, are $\frac{1}{80}$, and $\frac{1}{80}$, and
 $\frac{7}{8}$ of $\frac{1}{20}$ fa. $\frac{7}{160}$ } $\frac{7}{160}$, which reduce to a Common
 Denominator, and add them together, either by Decimals or Vulgar Fractions.

CHAP. XIX.

ADDITION of FRACTIONS.

1. IF the Fractions to be added have one Common Denominator, Add all the Numerators together, and divide the Product by the Common Denominator.

178. *Multiplication of Fractions. Chap. 21.*

	l.		l.	s.	d.
From	$\frac{7}{4}$	,875	the	$\frac{7}{4}$	is — 17 : 6
take	$\frac{3}{4}$	,75		$\frac{7}{4}$	is — 15
Rest		,125 or 2 : 6		rest	2 : 6
					equal to the Decimal, 125.

C H A P. XXI.

Multiplication of Fractions.

I. **T**O Multiply proper Fractions, Multiply the Numerators together for a new Numerator, and the Denominators multiply together for a Denominator.

Example. Multiply $\frac{7}{4}$ by $\frac{3}{4}$, facit $\frac{21}{16}$.

II. If a mixt Number and a Fraction are to be multiplied together, Reduce the mixt Number into an improper Fraction, and work as in the last.

Ex. Multiply $11 \frac{3}{4}$ by $\frac{1}{4}$

$\frac{3}{4}$ by $\frac{1}{4}$, facit $\frac{3}{16}$.

Ex. Multiply $11 \frac{3}{4}$ by $2 \frac{1}{4}$

$\frac{3}{4}$ by $\frac{1}{4}$, fa. $\frac{3}{16}$ or 32 : 1 : 8

III. To Multiply a mixt Number by an Integer, Make the Integer an improper Fraction by placing [1] under it, and Reduce your mixt Number into an improper Fraction, and work as in the first Rule.

Ex.

Chap. 22. Division of Fractions. 179

Example. Multiply $7\frac{1}{4}$ by 4.

$7\frac{1}{4}$ by 4, facit $29\frac{1}{4}$.

IV. *Multiplication of Decimals* is the same as in whole Numbers, saying as many Decimal parts as are in the Multiplicand and Multiplier, so many must be cut off from the Product, which if it have not so many places, the defect must be supplied with Cyphers towards the left hand.

Multiply ,1005
by ,031

1005
3015

facit ,0031155

11,83

2,87

8281

9464

2366

33,9521

C H A P. XXII.

DIVISION of FRACTIONS.

I. **T**O Divide Single Fractions : Reduce them to a Common Denominator, and Divide the new Numerator of the Dividend, by the new Numerator of the Divisor.

Example, Divide $\frac{7}{8}$ by $\frac{3}{4}$,

$\frac{7}{8}$ $\frac{3}{4}$
28 24

24) 28

facit $1\frac{1}{3}$ If

II. If it happens that the Fraction of the Divisor be greater than the Fraction of the Dividend, after you have Reduced them to a Common Denominator, the *facit* of such Division is a Fraction.

Example. Divide $\frac{1}{4}$ by $\frac{1}{2}$.

$$\frac{1}{24} \quad 28 \text{ facit } \frac{14}{11}.$$

III. To Divide an Integer by a Fraction, Multiply the Integer into the Denominator, and Divide by the Numerator.

Example Divide 8 by $\frac{1}{9}$.

$$\begin{array}{r} \text{5) } 48 \\ \hline \text{facit } 9 \frac{1}{2}. \end{array}$$

IV. To Divide a Fraction by an Integer, The Numerator is Numerator, and the Integer multiplied by the Denominator, is Denominator.

Example. Divide $\frac{1}{2}$ by 3, $\frac{4}{3}$

$$\frac{12 \text{ facit } \frac{3}{11}}{11}$$

V. To divide a mixt Number by an Integer, Reduce the mixt Number into an improper Fraction, whose Denominator multiply by the Integer for your Divisor.

Divide

Chap. 22. Division of Fractions. 181

Divide $3 \frac{1}{4}$ by 2

$$\begin{array}{r} 16 \overline{) 27} \\ 1 \overline{) 16} \text{ facit } 1 \frac{1}{2} \end{array}$$

VI. To Divide a mixt Number by a Fraction, Reduce the mixt Number into an improper Fraction, and work as before.

Example. Divide $3 \frac{1}{4}$ by $\frac{4}{5}$

$$\begin{array}{r} 105 \overline{) 105} \\ 16 \overline{) 105} \\ 9 \end{array}$$

facit $6 \frac{2}{5}$.

VII. To divide an Integer by a mixt Number, Reduce the mixt Number and Integer into improper Fractions, and proceed as before.

Example. Divide 5 by $1 \frac{1}{2}$

$$\begin{array}{r} 5 \overline{) 5} \\ 1 \overline{) 5} \end{array}$$

by $1 \frac{1}{2}$

$$18 \overline{) 25}$$

$$7$$

facit $1 \frac{7}{18}$

VIII. To Divide a mixt Number by a mixt Number, Reduce them into improper Fractions and Divide as before.

Example. Divide $3 \frac{3}{4}$ by $2 \frac{1}{2}$

$$\begin{array}{r} 11 \overline{) 11} \\ 1 \overline{) 11} \end{array}$$

by $1 \frac{1}{2}$

$$55 \overline{) 72}$$

facit $1 \frac{1}{5} \frac{1}{11}$

Division of Decimals is the same as in whole Numbers, till the Work be done. And then use the

182 *The Rule of Three, &c.* Chap. 23.

the Converse of the Rule for Multiplication, viz. so many Decimals as are in the Dividend, so many there must be in the Divisor and Quotient: And if there be not so many, the Quotient must be supplied with Cyphers towards the left hand.

Example. Divide 33.9521 by 2,87

$$\begin{array}{r}
 2,87 \overline{) 33.9521} \\
 \underline{574} \\
 2382 \\
 \underline{2381} \\
 00
 \end{array}$$

facit 11,83

See the Converse in Multiplication of Decimals.

C H A P. XXIII.

The Rule of Three in Fractions.

RULE: You must multiply your Second and Third Numbers together, and divide by your First.

Observing the same Method as in whole Numbers, viz. That the first and third Numbers be of one Name or Denomination.

Ex. If $3\frac{1}{2}$ buy $\frac{3}{4}$ of Tobacco, what shall $95\frac{1}{4}$ buy?

$$\begin{array}{r}
 \begin{array}{ccc}
 d. & lb. & l. \\
 3\frac{1}{2} & \text{buy } \frac{3}{4} & \text{of Tobacco, what shall } 95\frac{1}{4} \\
 \text{buy?} & \frac{7}{2} \text{ of } \frac{1}{40} &
 \end{array} \\
 \begin{array}{r}
 \frac{7}{2} \text{ of } \frac{1}{40} \\
 \frac{7}{2} \times \frac{1}{40} = \frac{7}{80} \\
 \frac{7}{80} \times 95\frac{1}{4} = \frac{7}{80} \times \frac{381}{4} = \frac{2667}{320} \\
 \frac{2667}{320} = 8\frac{157}{320}
 \end{array}
 \end{array}$$

Divide

$$\begin{array}{r}
 \text{Divide } 7\frac{6}{11} \text{ by } 7\frac{7}{11} \\
 \underline{7 \quad 766} \\
 84 \quad 2880 \\
 \quad 2880 \\
 \quad \underline{3360} \\
 84) 367680 \\
 \quad \underline{316} \\
 \text{facit } 4377 \text{ lb. } 648 \\
 \text{of Tobacco} \quad \underline{600} \\
 12
 \end{array}$$

CHAP. XXIV.

Mensuration of Plain Superficies.

The Mensuration of plain Superficies (or Flat Measure) such as Board, Glass, Wainscot, Painting, and the like.

Note 1. **T**HAT in Superficial Measure, 12 times 12 inches, being 144 Inches, are the Number of Inches contained in a Square Foot of Superficial Measure.

2. That to square any Number, is to multiply it in it self, as if you would know how many square Feet is contained in a Yard square. Multiply 3, the Feet in one Yard by 3, the Product is 9, and so many Feet make a Yard square.

Example.

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Example. How many square Inches are there in a Yard square ?

1 Yard is 3 Feet

$$\begin{array}{r} 12 \\ \hline 36 \text{ Inches} \\ 36 \\ \hline 216 \\ 108 \end{array}$$

facit 1296 Inches.

General Rule is to multiply the length by the breadth, the Product is the Content.

Ex. 1. A Board 12 Foot long, and 14 Inches broad, how many square feet ?

$$\begin{array}{r} 12 \\ \hline 144 \\ 14 \\ \hline 576 \\ 144 \\ \hline 144) 2016 \text{ Inch.} \\ \text{facit 14 feet 576} \end{array}$$

$$\begin{array}{r} \text{inch.} \quad 12 \text{ foot.} \\ 1 \frac{1}{2} \text{ ——— } 02 \\ \hline \text{facit 14 square feet} \end{array}$$

00

But the best way is to take Aliquot parts for 14 Inches, as you see wrought in the last Example. And this being the most practical and ready way, I shall pursue it in all the Variety of Superficial Mensuration that followeth.

Ex-

Chap. 24. Plain Superficies.

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Ex. 2. A piece of Wainscot 24 Foot, 9 Inches long, and 11 foot deep, how many square Yards?

foot inch.		yd. fo. in.
24—9		8—0—9 long.
11 Mult.	} Or thus,	3—2—0 deep.
9) 272—3		24—2—3
fa. 30 0—8		1 $\frac{1}{2}$ —2—2—3
		1 $\frac{1}{2}$ —2—2—3
		facit 30—0—9

Here 24 Foot 9 Inches is multiplied by 11 Foot, the height, which makes 272 Foot 3 Inches, that divided by 9, gives 30 Yards, 8 Inches, and $\frac{1}{2}$.

But the easiest and best way is to bring the height and length into Yards, and then multiply them as you see in the Example following.

Example 3. A Painter hath done a Room 98 Foot about, and 11 $\frac{1}{2}$ Foot high, I demand the square Yards therein?

yd. fo. in.	foot
32—2—0	3) 98
3—2—6	32—feet
98—0—0	
1 $\frac{1}{2}$ —10—2—8	yd. feet in.
1 $\frac{1}{2}$ —10—2—8	Ans. 125—0—8
6 $\frac{1}{2}$ —5—1—4	
Facit 125—0—8	

Example

Example. A Glazier hath done a Pane of Glass of 5 Foot, 73 high, and 2 Foot, 54 broad, at 6d. the Foot square.

Note, The Glaziers Foot is divided into 10 parts, and every part into 10 parts more.

$$\begin{array}{r}
 5, 73 \\
 5, 54 \\
 \hline
 2292 \\
 2865 \\
 \hline
 1145
 \end{array}$$

Facit 14 $\frac{1}{2}$ or 14, 5542 14, 5542 foot.

A General Rule to Measure Round or Square Pillars.

Multiply the length by the Circumference or Round Pillars.

And for Square Pillars, add the four sides or breadth together, and multiply the Total by the length.

Example 5. A Painter hath done a Pillar of 6 Foot 3 Inches Circumference, and 14 Foot 9 Inches long, I demand the Square Yards of Painting?

	yd.	fo.	in.	
	4	2	9	length.
	2	0	3	circumf.
	9	2	6	
inch.	36	3 $\frac{1}{2}$	0	1 $\frac{2}{3}$
	facit	10	1	0 $\frac{2}{3}$

Example

Chap. 25. *Mensuration of Solids.* 187

Example 6. A Pillar 6 Yard 2 Foot 5 Inches long, and 2 Foot 1 Inch in breadth each side, how many square Yards?

yd.	fo.	in.	
6	— 2 —	5	length.
3	— 0 —	0	breadth.
— — — — —			

yd. fo. in.

3 — 0 — 0 broad. *facit* 20 — 1 — 3

For *Regular Poligons*, add all the sides together, and multiply the Total by the length.

For *Cones*, multiply half the length by the Circumference.

For *Pyramids*, add all the breadths at the Base together, and multiply half the length by the Total.

For *Globes*, Multiply the Area of the Circle by 4, it gives the Content.

C H A P. XXV.

Mensuration of Solids.

Solids, such as Stone, Timber, &c. are Measured by the Cubick or Solid Foot, now a Cube is a Figure like a Dye of 6 equal sides, and a Cubick Foot contains 12 Inches Square on every side.

THE Rule is Multiply the length by the breadth, and that Product multiply by the depth, which divide by 1728, the Cubick Inches in a Foot solid. *Exam-*

Example.

A Piece of Timber 16 foot long, 14 Inches broad, and 9 Inches deep, how many solid Feet doth it contain?

$$\begin{array}{r} 12 \\ 12 \\ \hline 144 \\ 12 \\ \hline 1728 \end{array}$$

$$\begin{array}{r} 16 \\ 12 \\ \hline 192 \\ 14 \\ \hline 768 \\ 192 \\ \hline 2688 \\ 9 \\ \hline \end{array}$$

$$\begin{array}{r} 1728 \overline{) 2688} \text{ facit } 14 \text{ foot} \\ \underline{6912} \\ 14 \end{array}$$

ooo.

Exam-

Example.

A Stone 7 Foot 3 Inches long, 4 Foot 5 Inches broad, and 2 Foot 3 Inches deep, How many solid Foot?

$\begin{array}{r} 7-3 \\ 12 \end{array}$	$\begin{array}{r} 4-5 \\ 12 \end{array}$	$\begin{array}{r} 2-3 \\ 12 \end{array}$
87 length 53 breadth	53	27
261 435	1728)	124497
4611 27 deep	facit 72	3537
32277 9222	solid feet	81

fa. 124497 Cubick Inches.

To find how many Inches in length make a Foot of Square Timber, Multiply the Number of Inches square in it self for Divisor, and make 1728, the Cubical Inch of a Foot, your Dividend.

Example.

Example.

A Piece of Timber 18 Inches square, What length will it require to make a Foot solid ?

$$\begin{array}{r} 18 \\ 18 \\ \hline 144 \\ 18 \\ \hline 324 \overline{) 1728} \\ \text{facit } 5 \text{ In } 108 \end{array}$$

Example.

How many Inches in length will make a Foot at 12 Inches Square ?

$$\begin{array}{r} 12 \\ 12 \\ \hline 144 \overline{) 1728} \\ \text{facit } 12 \text{ In.} \\ 00 \end{array}$$

C H A P. XXVI.

Mensuration of Plank.

A Table shewing how many Foot of Plank of all Natures make a Load or Tun of Timber:

50 Foot a Load.

Inch. Foot.

4 Plank	150
3 —	200
2 $\frac{1}{2}$ —	240
2 —	300
1 $\frac{1}{2}$ —	400
1 —	600
$\frac{3}{4}$ —	800

make a Load.

3
4
4 $\frac{1}{2}$
6
8
12
16

which divided by, gives the quantity of Feet.

4 Plank	120
3 —	160
2 $\frac{1}{2}$ —	192
2 —	240
1 $\frac{1}{2}$ —	320
1 —	480
$\frac{3}{4}$ —	640

make a Tun.

3
4
4 $\frac{1}{2}$
6
8
12
16

which divided by, gives the quantity of Feet.

Example

Example.

In 7685 Foot of 4 Inch Plank, How many Load and Foot of Timber?

$$\begin{array}{r}
 15 \overline{) 7685} \\
 \underline{18} \\
 51
 \end{array}
 \qquad
 \begin{array}{r}
 3 \overline{) 35} \\
 \underline{11} \frac{1}{2}
 \end{array}$$

Load Foot
facit 51 11 $\frac{1}{2}$

35 11 $\frac{1}{2}$ Foot.
the remainder 35, divided by 3, makes Foot 11 $\frac{1}{2}$.

Example 2.

In 7685 Foot of 3 Inch Plank, How many Tun and Foot of Timber?

$$\begin{array}{r}
 16 \overline{) 7685} \\
 \underline{128} \\
 48
 \end{array}
 \qquad
 \begin{array}{r}
 4 \overline{) 5} \\
 \underline{05} \\
 1 \frac{1}{4}
 \end{array}$$

Tun. Foot.
facit 48—01 $\frac{1}{4}$.

The remainder of the Division is divided by the third Column, as in the Example above, the 7685 Foot is divided by 160, the number of Feet that make a Tun of 3 Inch Plank, and 5 remains, which divided by 4, the Figure even with it gives 1 Foot $\frac{1}{4}$, so the Facit is 48 Tun 1 $\frac{1}{4}$ Foot.

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T H E E N D.

Edward Gayton
His book 1711
